

The New Zealand Journal of Agriculture.

VOL. XXXI.—No. 6.

WELLINGTON, 21ST DECEMBER, 1925.

MINERAL ELEMENTS IN THE FEEDING OF STOCK.

THEIR VITAL IMPORTANCE.

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I. INTRODUCTION.

STARVATION is the rarest of deaths, but the commonest of ailments. The term "starvation" must not be limited to denote only a result caused by a lack of one kind of food, but must equally well be applied to the want of any essential kind of food—whether of a type such as the proteins, carbohydrates, and fats, consisting of the elements carbon, hydrogen, oxygen, sulphur, and nitrogen, the so-called organic elements, which supply the animal with warmth and energy and which constitute by far the greater bulk of the foodstuff; or of those other inorganic or mineral elements such as calcium, phosphorus, potassium, sodium, magnesium, iron, and chlorine, which provide material to form the bony skeleton and the blood, and have also the less obvious but more essential duty of providing the machinery for the chemical and physical processes which take place during life, and necessary for the beating of the heart, respiration, the working of the nervous system, for digestion and excretion, and the proper functioning of every organ of the animal body.

When an animal body is burnt in air the organic constituents are oxidized and disappear as gases, leaving an ash which contains for the most part the necessary mineral elements or inorganic food;

and the first step of the chemist to determine the amount of mineral food in any form of life is to reduce it to an ash free from carbon and the other combustible elements. In addition to the mineral elements present in the greatest amount in the ash, there are others present only in traces in the body of the animal, and which may be just as necessary to its life and health. These are iodine, manganese, fluorine, copper, zinc, arsenic, and possibly others.

Starvation due to the deficiency of any of the essential mineral elements may be specially indicated to distinguish it from that of the ordinary kind. Thus the term "calcium starvation" is used to denote cases where there is a deficiency of lime salts in the food-supply, resulting in malnutrition of the bones, or rickets; "iron starvation," to distinguish a want of iron in the food, leading to progressive anæmia; and "iodine starvation," to lack of iodine, leading to the development of simple goitre. The thought naturally arises, If lack of each of these elements gives rise to such definite and unmistakable symptoms, cannot lack of any other element when such a condition occurs be predicted from a knowledge of the symptoms? Such diagnosis is at present not attainable in our limited state of knowledge.

It used to be a source of wonder to many why it should be so much more difficult to keep some hundreds of fowls healthy than, say, a dozen. A small number of hens scratching round a homestead were never any trouble, and apparently nothing could be healthier; but let the amateur attempt to keep a few hundreds, and unless a study of rations and proper provision for all mineral foods is made disease will appear. It is the same with pigs; the "gentleman that pays the rent" and lives with the family, and picks up all the minerals it requires, thrives with very little attention; a dozen pigs in pens, however, would require not only energy foods but a nicely assorted mineral ration to enable them to put on the customary profit at the quickest rate.

It is noteworthy that deaths from actual starvation of any kind in human beings are so rare. It is recognized that even in the poorest communities the danger of improper feeding lies not so much in death from starvation, but in the lowered vitality caused by malnutrition leading to lack of resistance to other ills that flesh is heir to. This idea, which is accepted and acted upon by those charged with the rearing of children, is not so prominently realized by those who have the care of our domestic stock. The penalty of under-nourishment of stock through lack of the proper mineral foods in proper balance is not death from starvation, but from disease of all kinds, which spreads quickly through the flocks and herds and gains a rapid victory over the enfeebled host.

The pressing importance of the mineral elements in New Zealand agriculture is likely to be demonstrated in two classes: (1) Where the soil is deficient in or unable to yield to the pasture that amount of plant-food which the animal requires; and (2) where the animal is artificially fed. One may consider for the purpose of this article that all the New Zealand pastures, whether natural or induced, are the natural food of the domestic herbivoræ. When animals grazed on a New Zealand pasture of any kind do not thrive, and their condition is not referable to any communicable disease or to poison, their condition is due to starvation caused by a deficiency in the food available; either the quantity or the quality is at fault. When the quality is wrong the animals are probably suffering from some form of mineral deficiency.

An animal grazing on good mixed pasture will select its food to include all the elements required and so balance its own ration; little is here required with the exception of salt as a lick. In the case of stall or artificially fed animals the difficulties of giving the best balanced ration are very greatly increased, as the animal cannot correct an erroneous ration. It has no choice, and cannot be guided by palatableness, which would operate under more natural conditions. Hence the greatest advance which can immediately be made in the improvement of the feeding of domestic stock in New Zealand will probably be made in the case of pigs and poultry. It is exactly in these cases that so much progress in animal-nutrition research has been made in older countries, and it will be much more so in New Zealand, where the stall feeding and artificial feeding of ruminants are not generally practised, thanks to the long growing-period of the pasture.

There are, however, some extensive areas of land in the North Island, the porous, non-retentive soils of which cannot possibly be called normal, but on which, nevertheless, the ordinary pasture plants are able to grow owing to the good rainfall. Such plants in the droughty season of the year may not contain the requisite mineral ration for the animal. If grazed on such lands the animal is likely to suffer from mineral starvation, in spite of the seeming abundance of food; and following starvation is the consequent lessened resistance to disease. The plant is able to take up from the soil when the conditions are favourable very much more mineral food than is actually required, and it is probably this fact which enables ruminant stock to be grazed solely, continuously, and successfully on the richer pastures of the North Island and on those which are heavily top-dressed. One can therefore predict in pen-fed animals and in ruminants pastured on deficient soils an immediate and profitable response to any attempt to improve the mineral feeding, whether supplied directly to the animal by medicine, lick, or ration, or indirectly by top-dressing the pasture, and that such response will show itself not only by increased and quicker profits but in the improved health of the stock as shown by freedom from communicable disease.

It has been proved by experiment that an animal will die sooner on a diet which is entirely deficient in mineral matter than another animal which is given no food at all. This fact alone is sufficient to demonstrate the necessity of mineral food and the importance of ensuring an adequate supply of it. Further, an animal from which all food is withheld dies a peaceful and comparatively painless death, but an animal from which mineral food is withheld suffers from disturbances of the digestive system, convulsions, and other distressing symptoms.

At the outset of an inquiry of this kind one is met with the great lack of knowledge on just those points upon which accurate information is desired. The exact requirements of every domestic animal for every kind of mineral food are not even approximately known. With some elements we must therefore endeavour to present them in such form that the animal may select what it requires and so obtain a properly balanced ration. Pasture must be mixed—not too much grass on the one hand, nor clover on the other. A pasture consisting wholly of clover is bad. Where pasture is deficient in phosphates or calcium these must be supplied as top-dressing. The first indication

of this deficiency may be the appearance of "Waihi" disease, or some form of malnutrition of the bones.

In artificially fed animals these mineral nutrients are best fed as ground sterilized bonemeal. Lime, magnesia, and phosphoric acid are the compounds of which bone is composed, but it must not be supposed that the only function of bone is to provide a framework upon which the animal is built. Bone, in addition, is the repository of those compounds which are held, as money is in a bank, ready to be withdrawn for use by the animal when needed. To such an extent is this done when the animal needs lime and phosphate, and when the food is deficient in these mineral foods, that the bones become brittle, the joints sore and swollen, and a condition known as osteomalacia results. This condition is relieved at once by giving the animal a medicine containing the deficient foods only, and top-dressing the pasture with quick-acting phosphates, provided there is sufficient soil-moisture to carry the phosphate to the plant-roots. The condition occurs in many parts of the North Island, especially in droughty seasons, on land deficient in phosphates. Here, then, is a case in which the pasture is getting all the phosphates it requires to keep it alive, but that amount is not enough for the animal. Osteomalacia in cattle may sometimes be relieved by feeding steamed bonedust. In South African cases even unground bones have been given, these being greedily devoured. Ground mineral phosphate is considered to be not efficacious, so that evidently all forms of phosphate are not similarly curative.

A growing pig's daily ration should contain $\frac{1}{2}$ oz. lime, and that of a calf about 1 oz. The lactating cow requires to consume and assimilate a large quantity of mineral foods. A gallon of cow's milk contains, roughly, $\frac{1}{4}$ oz. of lime, $\frac{1}{8}$ oz. phosphoric acid, and $\frac{1}{16}$ oz. chlorine, and these are the three minerals most likely to be deficient in the food. But, as only half these quantities in the food are capable of being assimilated by the animal, double the amounts (or treble according to another authority) must be present.

The foregoing instances will show that the mineral elements are not the small, negligible factor in the feeding of farm-stock which many may suppose. Every farmer should know the importance of giving salt to his stock. Salt is sodium chloride, and commercial rock salt also contains a small amount of iodine. Salt is especially necessary to supply chlorine in the making of hydrochloric acid for the digestive juices, and it will be seen from the figures quoted that milk contains a comparatively large quantity of chlorine, so that salt is highly necessary for milch cows. An excessive amount of salt taken induces too great a thirst and consequent dilution of the gastric juices by the undue amount of water drunk by the animal.

Iron is a very important element, as the blood corpuscles contain it in quantity. A deficiency of iron compounds in the food causes anæmia, a condition which may be relieved by appropriate iron medicines, or by improving the pasture in the same way as calcium and phosphate deficiency is relieved, but using a phosphate containing iron. Different classes of animals are able to assimilate iron in different forms. Thus a pig can assimilate iron found as oxide in the earth or rocks or cinders. Cattle, on the other hand, appear to require it, when it is administered medicinally, in a form in which it is given to human beings—namely, as an organic salt such as the double citrate of iron

and ammonium. The most effective form of all, however, is the natural one contained in normal pasture.

It is important to notice that the fact of deficiency of mineral foods taking some time to show themselves in the animal is owing to the storage of these elements in the bones and liver. Another important fact to remember is that different classes of animals have a different requirement for food according to their rate of growth. Consequently, on a given pasture which is deficient in mineral food a rabbit would become sick first, then a sheep, next a cow, and last of all a horse. That is why malnutrition diseases are rare in the horse and so common in the sheep.

To show that this mineral feeding has an immediate and practicable side, some experiments with poultry at the Rowett Research Institute in Animal Nutrition, Aberdeen, may be quoted. Twenty-eight Leghorn pullets, with free access to oyster-shell and flint grit, and an adequate diet of wheat, maize, oats, and bran mash, were divided into two and given the following mixture: Steamed bone-flour, 100 parts; calcium carbonate, 40; salt, 40; sulphur, 10; oxide of iron, 10; potassic iodide, 1. This mixture was added to the mash in the proportion of one part to twenty of mash. The experiment was continued for a year. The result was that the average number of eggs per bird in the pen without added minerals was 107.4, while the birds which received added minerals laid an average of 178 eggs. In another experiment, lasting seven months, the birds without added minerals averaged 61.22 eggs, and those supplied with minerals 83.66 eggs. In a third experiment, lasting five months, the birds without minerals averaged 53.6 eggs, and those with minerals 67 eggs.

The conclusion of practical importance would seem to be that an addition to the mash of a mineral mixture such as that specified, or some food such as fish-meal, which contains a very large proportion of mineral matter, will lead to increased egg-production even when the poultry have plenty of green food and shell-grit and an outside run. (See *Scottish Journal of Agriculture*, July, 1925, p. 263.)

In an experiment with pigs the mineral elements were proved to be highly beneficial. Two groups of pigs were given a ration consisting of grains and grain offal, which contained 4.56 grams of phosphorus pentoxide (P_2O_5), but only 0.47 gram of lime (CaO). One group had in addition access to chalk, bonemeal, rock salt, and coal ashes. The results (as recorded in the *Scottish Journal of Agriculture* for July, 1922) were as follows:—

		Initial Weight. lb.	Weight after 124 Days. lb.	Gain. lb.
Ration only	..	32.1	101.4	69.3
Ration and added minerals	..	31.5	164.3	132.8

An excess of some mineral foods may prove harmful; therefore it is necessary in artificially fed animals to study the proper balance of the rations provided.

For much of the information to be presented in this article the writer is indebted to Dr. J. B. Orr, Director of the Rowett Institute, which was recently visited by the writer.

(To be continued.)

CHEWINGS FESCUE.

HISTORY, SEED-PRODUCTION, AND SEED-EXPORT PROBLEMS.

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CHEWINGS FESCUE is now comparatively unfamiliar to New Zealand agriculture, except in the district to which its seed-production is practically confined. Yet in the United States and Canada it is probably the best known of all the grass and clover seeds exported from this Dominion. Some years back Chewings fescue held a place in North Island pasture mixtures, but it has gradually given way to brown-top and *Danthonia pilosa*. As a fine-leaved lawn-grass, however, it ranks high. The great bulk of the New Zealand output of seed is exported, mainly to North America, for the turfing of golf-greens, bowling-greens, and various types of lawns. It is also a constituent of most lawn mixtures retailed in New Zealand.

The following notes are presented with two objects in view: firstly, of giving buyers and consumers of seed in New Zealand and abroad some idea as to where and how the seed is produced; and, secondly, to put before growers and commercial seed-houses the results of several experiments conducted in connection with the losses in vitality of the seed after shipment from the Dominion.

CLASSIFICATION.

Botanically, Chewings fescue is a variety of *Festuca rubra* L., and is described as *F. rubra* var. *fallax* Hackel, the essential difference between it and red fescue (*Festuca rubra* var. *genuina* Hackel) being the creeping habit of *F. rubra* var. *genuina* and the tufted, compact growth of *F. rubra* var. *fallax*. It is believed by many that Chewings fescue is the outcome of environmental changes subsequent to the introduction into New Zealand of the parent species. This is not so, as the variety is well known in Europe, especially in Germany, and the two descriptive common names "creeping red fescue" and "tufted red fescue" (Chewings) are assigned to them. Wittmack, in reference to tufted red fescue, says, "The seed is collected wild, partly in middle Germany, often mixed with sheep's fescue, but most comes from New Zealand. Unfortunately, this is only the tuft-forming variety."

The seeds of the two species are to all appearances identical, but, according to Stebler and Volkart, there are slight differences in the proportionate lengths and widths, length of awn, and weight per thousand, Chewings being the lighter of the two.

HISTORICAL.

Southland is the home of Chewings fescue in New Zealand, and it is there dominant over a large tract of poorer-class country. The authentic account of its introduction into Southland* rather confuses

* For these particulars the writer is indebted to Mr. G. Stevens, of Messrs. J. E. Watson and Co. (Limited), Invercargill.

the theory as to its origin, for, according to this, the original seed, the parent of all the fescue covering the present areas, was hard fescue (*Festuca ovina duriuscula* Koch), a form of sheep's fescue (*F. ovina* L.). According to the account, the original seed was supplied as hard fescue by a well-known firm of English seedsmen, and was sown about eleven miles out from Invercargill. Two years later the pasture was cut for seed, and was taken by a Mr. Tarlton and sown at Mossburn. This Mossburn property was later purchased by a Mr. Chewings, who harvested the fescue-field and marketed the seed, presumably as "Chewings's fescue." This would be about the year 1885. As all the present fescue areas of Southland originated from this one line of seed, it would appear that Chewings fescue is a variety

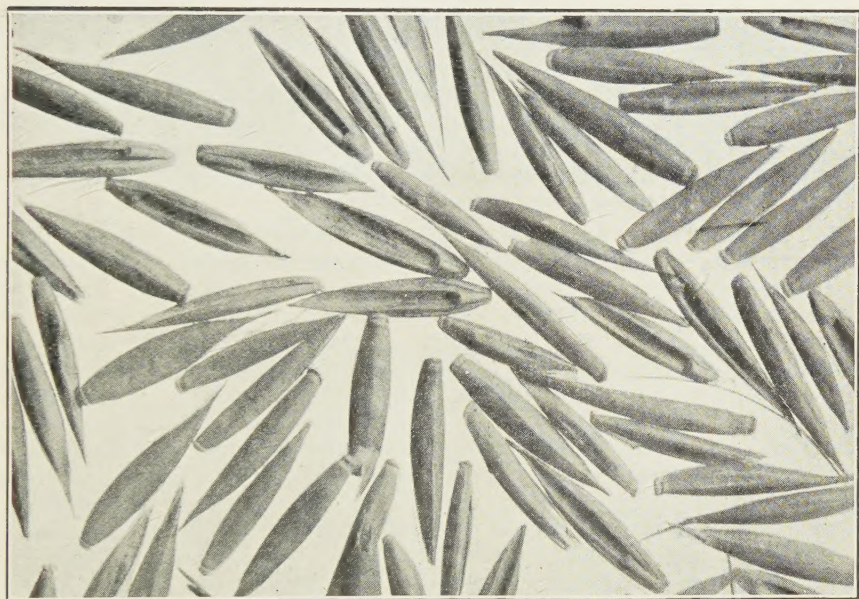


FIG. 1. SEED OF CHEWINGS FESCUE. MAGNIFIED 6 DIAMETERS.

[Photo by E. Bruce Levy.]

of *F. duriuscula* and not *F. rubra*; but, as botanical classifications of the plant place it indisputably as a variety of red fescue, it can only be assumed that an error was made in the original shipment, and that European red fescue (apparently the tufted form) was supplied instead of the hard fescue as specified.

SEED-PRODUCTION.

The main seed-producing area of Southland is the tract of country extending from Mossburn to Lumsden, Balfour, Riversdale, and Otama.

Total acreages and yields since 1915-16 (taken from the "New Zealand Official Year-book," 1925) are as follows:—

Season.			Acreage.	Yield. lb.	Average Yield per Acre. lb.
1915-16	..	..	5,787	1,230,219	212.5
1916-17	..	..	5,514	1,247,545	226.0
1917-18	..	..	4,372	1,013,042	232.0
1918-19	..	..	2,329	551,588	236.8
1919-20	..	..	3,425	827,769	241.0
1920-21	..	..	3,469	680,116	196.0
1921-22	..	..	6,231	1,650,327	264.8
1922-23	..	..	6,423	2,334,386	361.9
1924-25	..	..	9,279	1,499,177	161.5

These yields will be in undressed seed off the mill. The total amounts of dressed seed available for commercial purposes will, of course, be less—say, 20 per cent.—due to dressing losses. The high and low yields for the 1923 and 1924 seasons respectively should be noted.

This seed plays an important part in the prosperity of the fescue country in Southland, in that it is peculiarly adaptable to the soil and climate; and, while it provides a certain amount of palatable sheep-grazing, the return from it as a seed crop in many cases makes the local farming an economic proposition.

The seed is sown with a rye-grass and clover mixture (mainly perennial rye-grass), and occasionally with an oat cover. Pure sowings are sometimes made, but advantage is usually taken of the early grazing provided by the rye-grass and clover, which in two years goes out, leaving the fescue in possession. In the early part of the third year a seed crop is taken off, and this is followed by alternate grazing and seed crop for two or four years. These crops are known as first, second, and third cuts, the quality and yield of the seed decreasing with the age of the pasture. The turf is now generally quite sod-bound and unproductive, and may be turned in with a deep furrow and the rotation—oats, turnips, &c.—proceeded with, or may be renovated by skim-ploughing. This consists merely of the turning of a 7 in. or 8 in. furrow to a depth of 4 in., and setting it well up. The ploughed ground is left untouched, and the fescue reappears between the furrows. In due course two successive cuts are taken off. In the normal sequence this concludes the long fescue phase of the rotation, but it is not unusual to find a further renovation being undertaken for additional seed crops. This latter practice cannot be recommended, as it stands to reason that a pasture exhausted by continual cropping will consist of plants incapable of producing a heavy-weight seed of high vitality.

The crop is cut with the reaper-and-binder, the stripper being used only where a stand is thin. Unlike many other grasses, Chewings fescue ripens very evenly, and it is generally recognized that there is a margin of three or four days in which the crop may safely be cut. The frequent high winds on the Waimea Plains are a source of danger, as the fully ripe seed is very loose and quickly falls. The inclination of the grower, therefore, is to be on the safe side and to cut well before ripening is completed. Reference will be made to this point later.



FIG. 2. TYPICAL COUNTRY IN THE MOSSBURN DISTRICT.

Chewings fescue is here replacing the original pasture of rye-grass and clover.

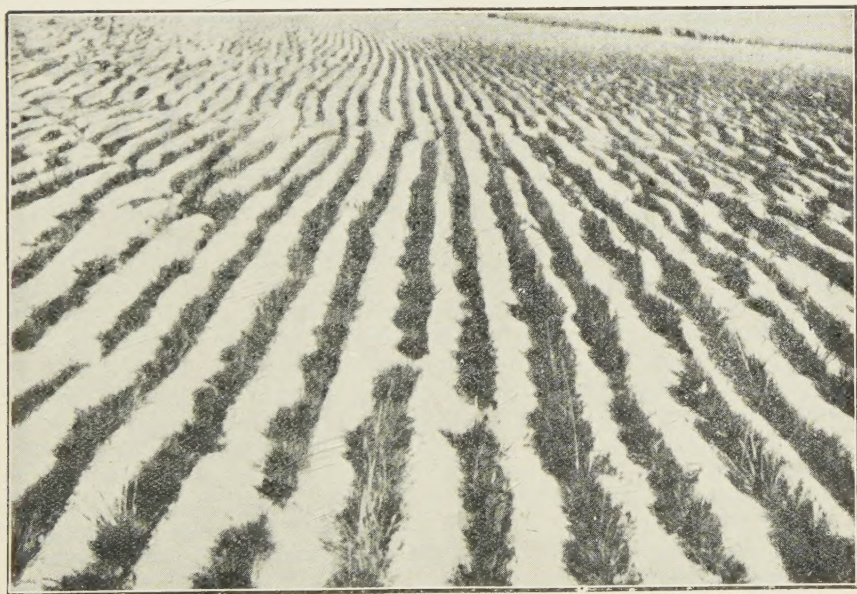


FIG. 2. CHEWINGS FESCUE COMING UP IN THE FURROWS AFTER PLOUGHING FOR RENOVATION.

[Photos by E. Bruce Levy.]

Threshing out of the stook is almost general. The time the crop is left in stook is governed to a large extent by the availability of the threshing-mill, but is usually not less than two weeks. Very occasionally the crop is stacked for six or eight weeks. Threshing out of stook is naturally more popular, for the reason that the grower completes the whole of his harvesting operations in a few weeks, and is able to dispose of his seed much earlier.

The seed comes off the mill weighing about 13-14 lb. per bushel. In this rough state it necessarily contains a high percentage of chaff and seed impurities, the quantity being dependent to a large extent on the age of the crop. A good average weight per sack is 70 lb., and an average yield is from four to five sacks per acre. A grower may sell on the spot on an undressed sample, or may have the seed cleaned and sell on a machine-dressed sample. Unlike cocksfoot, the buying of which is done on bushel-weight, Chewings fescue is bought for the most part on a germination test.

It will be seen from the foregoing that Chewings fescue seed-growing cannot be looked upon as an additional catch-crop, but that it is a primary feature of farming practice on this type of country in the district.

The bulk of the seed is dressed in large cleaning plants at Gore and Invercargill, where it is machined to its "natural weight," which varies from 20 lb. to 28 lb. per bushel, averaging 24-25 lb. The export trade is controlled from the two centres mentioned, and from Dunedin and Wellington. As previously stated, the bulk of the seed is shipped to North America, the United States absorbing on an average about 350 tons per annum.

GERMINATION PROBLEMS.

Machine-dressed fescue is practically always of a high standard of germination and purity. The figures computed at the official seed-testing station show the average germination to be 86 per cent., but it must be remembered that this figure covers average growths of all classes of seed. It can safely be said that good average new crop Chewings fescue may be expected to grow 90 per cent. or over (empty glumes, if any, included in this test).

While Chewings fescue is a fairly vigorous and a high-germinating seed, like most other fescues it does not retain its vitality for any great length of time. There are some exceptions, but as a rule the growth of Chewings does not hold much after eighteen months from time of harvest, and at two years the seed is practically inert. It is to be expected, therefore, that such a short-lived seed is extremely delicate and is very susceptible to adverse storage conditions, the degree of susceptibility being directly associated with vitality. This character of the seed is responsible for the serious losses in germination which occur subsequent to shipment from New Zealand. As a result of this feature many promising export markets have been lost, and during many years the existing trading has been carried on under difficulties and uncertainties.

Briefly, the position may be reviewed as follows: (1.) The American demand has always been the heaviest, but during the last few years has shown a gradual decrease until the present season, when practically

the whole of the light 1925 crop, together with the carry-over from 1924, was purchased by North America. Considering the existence of the general dissatisfaction of American importers with many previous deliveries, and the fact that the use of Chewings fescue is condemned by several American agronomists, it is most difficult to satisfactorily account for this demand for seed of any quality. Although it is not probable, it is hoped that the same demand will continue. (2.) Britain is a willing buyer, but, under the present uncertainty of the growth of seed shipped, imports very little. It is known definitely that, could satisfactory deliveries be made, Britain and the Continent of Europe could absorb up to three times the present output of Southland. (3.) A proportion of export lines of high germination capacity when shipped arrive at their destination without serious loss. (4.) A proportion of export lines arrive at their destinations with losses ranging from 10 per cent. to 80 per cent.

Various theories have been advanced to account for this deterioration in vitality. They may be briefly stated as follows, each being followed by comments in brackets:—

(a.) Chewings fescue is a short-lived seed, and cannot be expected to retain its vitality during shipment overseas. [Storage experiments have shown that good average seed will store from eighteen months to two years.]

(b.) High temperatures experienced while crossing the tropics have a bad effect. [Frequently two different lines of high germination have been shipped on the one steamer, one arriving with a high growth, the other with a low one.]

(c.) Bad effects of machine-cleaning—that the seed is frequently too severely hummelled. [The seed-testing station has stored samples of dressed and undressed seed of the same lines, and in every case the rate of decline in growth was the same.]

(d.) The existence of parasitic fungous growth on the seed, which destroys the germ. [This theory was advanced in England, but later abandoned.]

(e.) Effects of steamer stowage—different holds and associated cargoes. [In experimental shipments sacks of seeds have been placed as near as possible to the boilers, but showed no harmful effects. Stowage of seed with wool-bales would be harmful.]

(f.) Seed from first-cut maiden pasture or first-cut regenerated fields should alone be saved. [It is generally recognized that the first cuts yield the best-quality seed, but a single cut would not pay the grower.]

(g.) Chewings fescue has “gone back”—that is, through repeated sowings of seed from the same areas the plants have less vigorous growth and bear seeds of low vitality. [This is a popular theory, but the matter of inter-hybridization cannot be discussed here. There is no doubt that a great variation in plant-type exists, but whether seeds from the various types differ in vitality has not yet been ascertained.]

(h.) Fertilizer top-dressing is required. [It is reasonable to suppose that the replacement of elements removed year after year would have beneficial results both in regard to grazing and seeding.]

(i.) The existence on the seed-stalk of a brown stain caused by the fungus *Helminthosporium sativum*. [This is very common in

Southland, especially on the older growths, and is said to have been observed for the last twenty years. Although there is nothing definite on the point, it is certain to have a weakening effect on the seed through the prevention of a free flow of sap to the seed-head. The fact that it is present mainly on weakened growths strengthens the argument in favour of top-dressing.]

(j.) Effects on seed-maturity of early cutting and threshing too soon after cutting. [There is no doubt that much of the seed harvested in Southland is cut too early, before the final maturation processes have commenced. These processes commence when the seed is at the stage known as "ripe," but not "dead-ripe." This is when cutting should take place, the final maturing being allowed to take place in the straw. This takes some weeks, and is usually prevented by stook-threshing.]

DEPARTMENTAL EXPERIMENTS.

These have not been as extensive as one would desire. They have furnished, however, an amount of valuable data on the behaviour of the seed, and have given an indication as to which of the above-stated factors are responsible for the shipment troubles.

Series No. 1.

This series was commenced in 1920 in co-operation with the United States Department of Agriculture, Washington. A tabulation of the results is shown in Table 1.

Procedure: Of twelve sacks of a single line of high-grade seed, one was shipped to Washington via San Francisco every alternate month for a period of two years. Tests were made on each sack at time of shipment and again on arrival in Washington. There each sack was stored under good conditions and a test sample drawn every alternate month.

Table 1.—Showing the Results of No. 1 Series of Experiments.

The figures in bold type give the germination when the sack left New Zealand. The difference between the bold figure and the next in the same line gives the fall during transport from Wellington to Washington. Reading the bold figures down on the angles gives the fall in germination during storage in New Zealand. Reading horizontally gives the test results of each individual sack during storage in the United States. Reading vertically gives the state of vitality of each sack after shipment in the month indicated.

Sack No.		1920.					1921.						1922.	
		April.	June.	Aug.	Oct.	Dec.	Feb.	April.	June.	Aug.	Oct.	Dec.	Feb.	April.
		%	%	%	%	%	%	%	%	%	%	%	%	%
I	..	95	80	69	30	28	30	29	18	11	7	5	4	4
2	..	..	89	87	77	71	53	49	50	30	24	23	17	14
3	..	..	..	87	82	80	79	77	57	36	27	24	23	28
4	..	..	..	..	89	..	(Lost in transit.)							
5	..	..	..	..	..	85	83	68	58	29	19	22	18	20
6	..	..	..	..	..	..	86	74	..	..	26	21	..	17
7	..	..	..	..	..	..	..	71	38	6	4	5	1	1
8	..	..	..	..	..	..	..	..	73	18	3	2	3	1
9	..	..	..	..	..	..	..	..	..	63	13	10	11	2
10	..	..	..	..	..	..	..	..	..	..	55	23	12	8
11	..	..	..	..	..	..	..	..	..	..	..	41	20	6
12	..	..	..	..	..	..	..	..	..	..	..	..	18	17

NOTE.—Sacks Nos. 6 and 7 stowed forward in No. 1 hold; remainder in No. 2 hold just forward of the bridge.

Results: This series furnished very little information other than that Chewings fescue could lose its vitality in a remarkably short space of time. For the twelve months after harvesting (up to sack No. 6) no serious fall took place during transit, but the fall subsequent to arrival was extremely rapid. Thereafter the decline during both transit and storage was very marked. It has been suggested that Continental rail transport from San Francisco to Washington may have had harmful effect, and that in the first test made the injury would not be evident.

Series No. 2.

This was commenced in 1923 in co-operation with Messrs. Sutton and Sons, Reading, England. The results are shown in Table 2.

Procedure: Twenty-four lots of seed, with bushel-weights ranging from 17 lb. to 28 lb., were divided into three, two portions being shipped to Suttons and the other retained here for two monthly tests. Of the two shipped, one was forwarded as ordinary cargo and the other in cool storage. Tests were conducted here and by Suttons every alternate month. Moisture tests were also made here and in England (five hours at 100° C.) on Nos. 1-12. The losses of moisture during shipment are shown in Table 3. As the whole of the seed arrived in excellent condition it is impossible to correlate these figures with vitality. They are given here for the reason that they will be of interest to seed-exporters. The fact that the loss in cool storage is quite regular, while the loss as ordinary cargo is less and increases with bushel-weight, is of interest.

Results: In this series the behaviour of the seed was directly the reverse to that in Series No. 1, for during a period of twelve months from harvest the fall in growth was scarcely perceptible. If anything, the seed shipped in cool storage carried a little better than that carried as ordinary cargo; but the difference is not sufficient to warrant recommendation towards making the bulk shipments in cool storage, the cost of which in any case would be prohibitive.

Unfortunately, Messrs. Sutton, through pressure of work at their seed-testing establishment, were unable to continue these tests until the growth of the seed ran out. This would have demonstrated which of the samples could retain vitality for the longest period, and also the length of time. Tests made at our New Zealand station record these data, and comparisons with these and the English tests would have given an indication of the actual lowering of vitality of each individual line. However, the number of tests made was sufficient to show that the seed from the 1923 crop was of an unusually high quality.

Further, the extended New Zealand tests showed that, contrary to expectation, certain samples of a lower bushel-weight retained vitality for a longer period than did others of a high weight. Especially is this the case with No. 2, where a low-weight seed of poor appearance retained vitality for the longest period. An explanation of both these peculiarities is offered. In 1923 the crop in Southland was delayed about one month by wet weather, and in consequence the seed was allowed sufficient time to almost completely mature. Secondly, the history of line No. 2 showed that through wet weather it was cut particularly late, was left in stook for about six weeks, stacked for

about one month, and then threshed. The seed was a rather dirty straw colour, and commercially practically useless on this account. It was thoroughly and properly matured, however, and at the present time, out of the twenty-four lines, is the only one showing any growth in four days. Thus a series of experiments designed to test shipment effects furnished information of a different type. Messrs. Sutton's comments on the tests of this 1923 seed are of interest. They state: "We would like to say that these figures are very considerably above the average results obtained with Chewings fescue from New Zealand during the past ten years, and, for some reason quite unknown to us, the germination of Chewings fescue generally is far better than anything we can remember for at least twelve years."

Table 3.—Showing Loss of Moisture in Twelve Lines of Seed during Shipment from New Zealand both as Ordinary Cargo and in Cool Storage.

Line No.	Bushel-weight.	Percentage of Moisture at Time of Shipment.	Loss of Moisture.	
			Ordinary Cargo.	Cool Storage.
	lb.		%	%
1	17	13.35	1.8	2.8
2	21	13.60	1.2	2.8
3	21-22	13.44	1.5	2.8
4	22	13.45	1.9	2.7
5	22	13.39	2.0	2.7
6	22-23	13.80	2.3	2.4
7	23-24	13.21	2.4	3.0
8	23-24	13.39	2.5	2.8
9	24	13.70	2.4	2.8
10	24	13.63	2.8	3.1
11	25	13.59	3.0	2.8
12	28	13.50	2.6	2.7

Series No. 3.

This series was commenced in 1924. The weather conditions at the time of the 1924 harvest were the reverse of those of 1923, and the harvest took place earlier than usual. The No. 2 series of experiments were therefore repeated with 1924 seed in order to ascertain the difference in the behaviour of the seed for the two respective years.

Procedure: As before, the seed was divided and sent as ordinary cargo and in cool storage, but with the difference that with each line was sent a portion of the undressed seed to test the effect of machining on vitality. Apparently, through some misunderstanding, the test results are being retained until the growth has run out, and not forwarded every two months as was intended. The results have been written for, and when received will be published in the *Journal*. The results of the test carried out here are available, however, and are shown in Table 4. If any monthly column is taken it will be seen that, although the bushel-weights of the eight 1923 lines shown are lower, the average growth is higher. In January, when the seed is about twelve months old, the comparative value of the seed of the two years is particularly noticeable.

Table 4.—Showing Results of New Zealand Tests of Year 1924 Lines compared with those of 1923 Seed.

Line No.	Bushel-weight.	1924 Seed.							
		July, 1924.	Sept., 1924.	Nov., 1924.	Jan., 1925.	March, 1925.	May, 1925.	July, 1925.	Sept., 1925.
	lb.	%	%	%	%	%	%	%	%
22 ..	19-20	64	61	53	25	21	15	9	1
23 ..	22	85	86	73	44	43	43	32	24
24 ..	22-23	94	90	84	77	66	60	54	46
25 ..	23	92	90	79	52	49	41	35	29
26 ..	24	93	82	84	63	58	53	42	31
27 ..	24	93	95	92C	80	76	68	62	60
28 ..	25	96	92	91	79	74	67	56	44
29 ..	25	96	82	79	61	57	50	43	32

1923 Seed (showing fall of first eight lines over same length of time).

Line No.	Bushel-weight.	July, 1923.	Sept., 1923.	Nov., 1923.	Jan., 1924.	March, 1924.	May, 1924.	July, 1924.	Sept., 1924.
	lb.	%	%	%	%	%	%	%	%
1 ..	17	85	83	72	56	47	38	34	27
2 ..	21	96	95	89	93	86	83	83	80
3 ..	21-22	94	93	92	83	85	79	69	69
4 ..	22	94	92	83	90	86	71	69	64
5 ..	22	92	88	82	83	77	58	54	49
6 ..	22-23	96	94	85	86	81	69	60	55
7 ..	23-24	94	92	89	89	77	64	64	55
8 ..	23-24	95	93	91	94	91	68	68	54

Series No. 4.

This was commenced in 1925, and was designed to test the effects of early and late cutting.

Procedure: Arrangements were made with Mr. S. Lynch, of Riversdale, to allow portion of one of his crops to remain standing. A strip through the middle of the field was reserved, and was cut three weeks later than the main crop. A quantity of seed from each cut was obtained, and part has been sent to England and part to Canada for testing purposes. Seed was also saved from several stooks which had been allowed to remain out in the paddock for some weeks. In addition to these, odd lots of seed from crops which had been partly stacked and partly stook-threshed were obtained and forwarded to Canada.

Series No. 5.

In 1924 Mr. R. McGillivray, Instructor in Agriculture, Invercargill, commenced a series of top-dressing experiments on the property of Mr. W. Young, of Mossburn.

Procedure: Four $\frac{1}{4}$ -acre plots were marked off and treated as follows, the dressings given being per acre: Plot 1, superphosphate (36/38), 1 cwt. Plot 2, superphosphate (36/38), 1 cwt.; blood-and-bone, $\frac{1}{2}$ cwt. Plot 3, control (no manure). Plot 4, superphosphate, 1 cwt.; blood-and-bone, $\frac{1}{2}$ cwt.; potash (30 per cent.), 1 cwt. These

plots were treated and seeded by Mr. Young under the supervision of Mr. McGillivray, and the seed handed to the writer for testing purposes.

The four lots have been forwarded with the seed of the No. 4 series of experiments. The results of both series (Nos. 4 and 5) will be published when the experiments are completed. Both may be regarded as preliminaries to experiments of the same nature on a much larger scale.

Miscellaneous.

In addition to these four series a large number of laboratory experiments have been conducted, which have furnished much information as to the general behaviour of the seed. Among these may be mentioned the following:—

(a.) Effects of various conditions and temperatures of storage: Seed in sealed containers stored better in light than in darkness.

(b.) Effect of various periods of cool storage: The fall in germination was greater in the case of cool-stored seed. This was thought to be due to excess CO_2 (carbonic-acid gas) in the store.

(c.) Effect of storage on dressed and undressed seed: The rate of fall in each case was approximately the same.

(d.) Effect of storage under various degrees of humidity.

One particular sample has been held since 1923, and still shows a growth of 90 per cent. in four days, while another portion under ordinary conditions grows 6 per cent. in eighteen days. This will form the basis of a future series of experiments, designed to test the possibility of special storage for bulk export.

CONCLUSIONS.

It has been general to regard factors operating on shipboard (principally tropical temperatures and high humidity) as being responsible for the deterioration of Chewings fescue while in transit. It is now, however, becoming recognized that not one single factor but a combination of factors is the cause of the deterioration. This is evidenced by the fact that some seed will arrive in perfect condition, while another line on the same boat is seriously affected, both being of a high growth when shipped. It therefore follows that ocean transit conditions have brought about deterioration, but that one particular line was resistant to the adverse conditions affecting the other. Likewise we have the case of one season's seed as a whole retaining its vitality for a longer period and shipping more satisfactorily than that of another season. It is therefore obvious that the other factor is operating prior to shipment.

Storage experiments have shown that machining has not affected seed during storage in New Zealand, and in any case it is not likely that dressing would materially weaken the germination.

There remains, therefore, only the factor of harvesting. It is well known that all living bodies—animals or plants—are more susceptible to disease if the vitality of that body is low. The same rule may be applied equally to seeds, which are living units carrying out the ordinary respiratory functions. It follows, then, that seeds of a high vitality have greater powers of resistance to adverse

temperature conditions, &c., than seeds of a low vitality; and in logical sequence it again follows that as immature seed is always of a low vitality it is this seed which, although apparently ripe, is damaged during transit and also loses its capacity of growth quickly under ordinary storage conditions.

Vitality of seed may be said to be the energy held by the germ, and must not be confused with the total percentage of germination. Vitality is measured by the speed and the vigour with which germination takes place, while percentage of germination is the total growth during a specified time. Seed of high vitality, then, germinates quickly and is more resistant to adversity.

The main factors influencing seed-vitality are (a) degree of maturity of the seed, and (b) strength of the plants producing the seed.

Maturity: As already stated, it would appear that many of the crops in Southland are cut too early and are not allowed the necessary time for the final maturation processes. Further, the crop when cut is frequently not given sufficient time in the straw, and is threshed out before the whole of the straw-sap has moved into the seed. These processes are necessary for the production of a thoroughly mature seed of a high vitality. Immature seed, although apparently ripe, will usually show a satisfactory total germination, but the vitality is always low. As previously stated, vitality is measured by speed of growth, and reference to Table 5 will show the difference between the speeds of growth of 1923 and 1924 seed, the former being thoroughly mature through late harvesting, and the latter immature through early harvesting.

Table 5.—Showing Comparative Four-day Growths of 1923 and 1924 Seed.

Refer to Table 4 for total germination at these periods. Note No. 2 and No. 5 of 1923, and refer to Table 2 for germination in January in England.

1923 Seed.				1924 Seed.			
Line No.	Four-day Growth, July, 1923.	Four-day Growth, Jan., 1924.	Bushel-weight.	Line No.	Four-day Growth, July, 1924.	Four-day Growth, Jan., 1925.	Bushel-weight.
	%	%	lb.		%	%	lb.
1 ..	61	24	17	22 ..	5	0	19-20
2 ..	92	75	21	23 ..	18	3	22
3 ..	84	51	21-22	24 ..	39	7	22-23
4 ..	80	41	22	25 ..	17	0	23
5 ..	40	36	22	26 ..	22	18	24
6 ..	73	56	22-23	27 ..	60	42	24
7 ..	79	50	23-24	28 ..	35	17	25
8 ..	84	62	23-24	29 ..	27	13	25

The average yields of the 1923 and 1924 seasons are of interest. The 1922 yield (265 lb. per acre) can be considered a good average yield, and during that year a fair proportion of the seed did not ship well. In 1923 the yield (362 lb. per acre) was high, due to predominance of well-matured plump seed. Commercially, however, the seed was not a success; it was "poor" in colour and its general appearance against it. This was the finest seed produced in Southland for ten years. In 1924 the yield was very low (162 lb. per acre), and the seed

generally of a lower standard of vitality, but commercially it was "excellent" in appearance. In 1923 the seed was dark straw-grey in colour, and in 1924 the blue-purple grey predominated.

Colour is important commercially, but it is a disputed point as to whether the highly coloured seed is the most mature. The indications are that it is not, and that seed straw-coloured on the glume and grey over the kernel is of the best type.

Strength of the plants: Weak, thin plants cannot produce strong, heavy-bodied seed. The greater the number of cuts taken off, the weaker will be the plants and the greater the degree of soil-exhaustion. In this connection the statement of a prominent English firm of seedsmen regarding Chewings fescue is of interest. They state: "Ten years ago and before that period this seed reached us usually weighing 28-30 lb. to the bushel; it now, as you probably know, rarely runs above 24 lb. on the average." This was brought under the notice of one of our Southern seedsmen, who stated that ten years ago seed came off the mill weighing 24-26 lb. per bushel, whereas 16-17 lb. is considered very satisfactory nowadays. These statements clearly support the theory of weakened plants resulting from soil-exhaustion. The absence of certain soil-constituents also affects speed of maturity.

RECOMMENDATIONS TO GROWERS.

Growers are advised to pay every attention to the production of mature seed, by delaying as far as possible cutting and threshing. It is fully realized that by extending the period of ripening there is a danger of loss by falling seed during heavy winds. This danger is, of course, less in wet than in dry weather, when the seed is much looser in the head. It is difficult to give a definite idea as to the best time to cut, as this will largely be governed by climatic conditions and will vary in different localities. It must be remembered that an extension of a day or two is valuable when seed is maturing.

If possible, the crop should be stacked for six or eight weeks after cutting. Stacking assists maturation, and the seed threshes out in better condition. If stacking is not possible, then threshing from the stook should not take place before three or four weeks.

Healthy vigorous pasture should be maintained by limiting the fescue phase of the rotation to two cuts after skim-ploughing, and by the application of artificial fertilizers. Information regarding top-dressing principles and procedure can be obtained from Mr. R. McGillivray, Instructor in Agriculture, Invercargill, who is conducting the manurial side of this investigation, and who in future will be associated with the writer in the field experiments generally.

POINTS FOR SEED-MERCHANTS.

The idea is prevalent among many merchants handling Chewings fescue that the remedy of the trouble here dealt with lies wholly with the growers. This is not entirely the case, for much of the ill reputation accorded to Chewings fescue overseas is due to the indiscriminate buying and shipping of seed which should never have left the grower's paddock. If a merchant is prepared to buy anything labelled "Chewings

fescue," then one cannot expect the grower to endeavour to produce high-grade seed. High-grade should be purchased on a quality basis, and the low-grade seed left alone, or at least not included in export lines. Blending covers a multitude of sins, and, while there is nothing against the blending of high-grade and good average seed, there is no doubt that many good lines are rendered low-grade by the addition of low-vitality seed. An equally bad practice is the blending of year-old seed with new season's. Blending year-old seed of some other species may be feasible, but not so with Chewings fescue. Vitality decreases with age, and at eighteen months, although the total growth may be reasonably high, vitality is too low for shipment purposes. Of course, should foreign buyers be prepared to take low-grade seed, it is a different matter, but generally this class of buyer is rare.

Merchants are advised to pay more attention to the percentage of growth in eight days and less to the final test. The eight-day growth gives a far greater indication of the value of a seed than does the total germination percentage. Finally, they should buy only the best, and in so doing eliminate the worst.

FUTURE EXPERIMENTS.

Growers are now fully alive to the position and are taking an active interest. Co-operative experiments will shortly be commenced on the farms of several growers with the object of obtaining data on the following points: (1) Effect on vitality of cutting at various periods; (2) effect on vitality of length of time in the stook; (3) effect on vitality of stacking as against stook-threshing; (4) degree of loss by delayed cutting for various periods; and (5) effect of top-dressing on yield and on maturity.

Laboratory experiments will be conducted on (1) colour as an indication of maturity, and (2) degree of humidity in relation to life of seed.

ACKNOWLEDGMENTS.

The writer desires to thank Mr. G. Bishop, of Messrs. J. E. Watson and Co., Gore, and Mr. J. Macassey, of Messrs. A. S. Paterson and Co., Dunedin, for valuable advice and assistance, and, together with Messrs. Wright, Stephenson, and Co., Gore, for supplies of seed; to Messrs. Sutton and Sons, Reading, England, and the United States Department of Agriculture, Washington, for interested co-operation in carrying out germination tests; to Mr. S. Lynch, of Riversdale, for co-operation in field experiments; and to Mr. R. McGillivray, Invercargill, for assistance and advice generally.

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THE SECOND IMPERIAL ENTOMOLOGICAL CONFERENCE.

INSECTS AND THE WELFARE OF MAN.

J. G. MYERS, New Zealand Delegate to Conference.

"It is not too much to say that the margin between sufficiency and starvation for the needs of the increasing population of the world during the next fifty years will in a large measure depend upon the success or failure of the work of trained entomologists." These words of the New Zealand delegate to the First Imperial Entomological Conference may fittingly introduce a short account of the second Conference and of the place of entomology in the economy of the Empire.

In 1920, at the first Conference, it was decided to hold similar meetings every five years. Accordingly, at the instance of the Honorary Managing Committee of the Imperial Bureau of Entomology, the Secretary of State for the Colonies issued invitations to the oversea Governments for a Conference in London in June, 1925. The official delegates represented no fewer than twenty-six dominions and colonies, from the Territory of Northern Ireland southward to the Union of South Africa, and from Trinidad eastward to the Malay States, Fiji, and New Zealand. But the delegates represented more than this; fortunately for the success of the Conference and for its value as a meeting-ground for scientific discussion they were also, to a large measure, representative of applied entomology in the countries which had sent them. It is regrettable that a few of the dependencies sent non-entomological delegates. For the greatest success of such a meeting it is essential that the delegates be technically capable of discussing on a common basis of knowledge the entomological problems of the countries concerned. To the high proportion of working entomologists among the delegates, and to the care and efficiency of the authorities in charge of the Conference arrangements, must be attributed the outstanding success of the meeting—a success which will probably contribute to the consideration of the successive Imperial Entomological Conferences, as milestones in the progress of applied entomology within the Empire.

At the outset, a delegate must find it by no means an easy task in a written report to do justice to the benefits accruing from the Conference. What must we take as the measure of such a meeting's success? Not the total contents of papers read; not the stimulating discussions following their delivery; not the deliberations of the special committees, nor the resolutions passed by the Conference as a whole; not the new publicity given to the fact that applied entomology is a vital force in our midst—not any one of these activities, nor yet their *tout ensemble*, presents a fair or a complete picture of the work of such a Conference. But although it has become a truism that the greatest value of scientific conferences lies in the establishment of personal contacts and the interchange of opinions behind the lines, as it were, yet the report of such a meeting, either because of the

essentially personal nature of the benefits derived, or even because the delegate is often unconscious of their full extent himself, must deal largely with the above-enumerated outward and visible signs of an inner grace.

The proceedings opened with an address by Earl Buxton, Chairman of the Managing Committee of the Imperial Bureau of Entomology. He described the very great increase which had taken place year by year in the work of the Bureau since its foundation in 1913; and he was glad to be able to report that the minimum revenue of the Bureau as suggested by the 1920 Conference was now in sight. This sum, £13,000, is, however, by no means large, and an increase would enable the operations of the Bureau to be very advantageously extended. The United States Bureau of Entomology, for comparison, receives as much as half a million sterling in annual appropriations.

To New Zealand farmers unacquainted with the work of the Imperial Bureau a few words of explanation may be here appropriate. Every month the Bureau publishes a *Review of Applied Entomology* in two series, one covering agricultural entomology in the widest sense, and the other dealing with the medical and veterinary aspects of the science. English abstracts are given of papers in all European languages and in several Oriental tongues. No other publication covers the whole field of entomology in its economic applications in so comprehensive and in so rapid a manner. The *Review of Applied Entomology* is now the first essential of the economic entomologist throughout the world, and for the entomological pioneer far distant from library facilities and in the farthest outposts of colonization it is often the one means by which he may learn of the work of others. The *Review* is thus of international importance.

As a second great feature of its activities the Bureau identifies insects sent in by working entomologists from all parts of the world, and acts as a central clearing-house for entomological matters throughout the Empire. During the year 1924-25 no fewer than 63,676 specimens were dealt with in this way. With the steady increase in the number of insect species recorded as pests, and with the progress in the study of their parasites and other natural enemies, such a service becomes every year more essential. And every year, too, it becomes more difficult for the overseas entomologist, away from great central reference collections like that of the British Museum, to identify the insects on and with which he is working. Until the entomologist knows the name and systematic affinities of the insect he has to control he is groping in the dark; his results may be not only useless but often positively misleading. It can be no exaggeration to state that the progress of entomology in New Zealand has been delayed twenty years by mis- or non-identification of the insects concerned. The correct name of an insect—a mere double-barrelled Latin tag to the layman—is the key to all recorded knowledge of that insect; it is the “open sesame” to the storehouse of human experience regarding that insect and its allies.

Did the Imperial Bureau confine its activities to these two departments it would still repay in full measure the annual contributions made to its upkeep by the respective oversea Governments. But it concerns itself also with the publication of other journals, including the *Bulletin of Entomological Research* and the *Insecta* portion of the *Zoological*

Record; it distributes collections of named insects to educational institutions and to oversea Governments; it lends books and papers to oversea workers; and finally it exports beneficial parasites to the colonies and dominions. A plan was brought before the Conference by which the last-mentioned activity would be considerably extended and placed on a permanent basis. New Zealand has already reaped some benefits from this parasite work by the receipt of consignments of earwig and pear "slug" enemies at the Cawthron Institute. More recently the task of the present delegate in finding, studying, and despatching to the Department of Agriculture in New Zealand parasites of the pear-leaf-curling midge was very materially facilitated by the Bureau, and since his departure from Europe this work is being continued under the direct auspices of the same institution.

With the numerous papers on all aspects of economic entomology presented at the sessions of the Conference it is not proposed to deal here. But the very able address of Dr. G. A. K. Marshall, Director of the Imperial Bureau of Entomology, on the aims and organization of economic entomology, requires more than passing mention. Applied entomology has evolved largely in response to conditions of large-scale agriculture in new countries where the rule-of-thumb procedure which achieved satisfactory results in the older settled countries was left helpless against huge outbreaks of pests. On the overseas biologist visiting England, or, indeed, any of the older European countries, the deepest impression is one of balance between man's agricultural and pastoral activities and the operations of nature. The two have functioned for so many centuries side by side that the old antagonists, if not lying down together like the lion and the lamb, at least seem to enjoy a fairly permanent armistice. But in a new country, how far different is the case. The landscape may be swept clean of forest by fire, and the native vegetation may be replaced, as in New Zealand, by a highly unstable plant-formation in the form of grassland, or, as in other countries, by practically pure stands of single species like sugar-cane or cotton. Insects living on such plants find their food increased beyond all bounds, and they themselves multiply proportionately. The problem of control then assumes such vast proportions that almost necessarily it becomes a matter for Government action.

Dr. Marshall, beginning his address, stated that under the system which now prevails in most countries where agricultural entomology is organized the farmer calls in the entomologist usually, if at all, only when the damage is done. The psychological attitude of the farmer in these matters, due entirely to the development of applied entomology as outlined above, is radically unsound. What is needed is the application of entomology to all stages of agricultural practice in order to prevent rather than to control insect attack. Such co-operation can, however, hardly be accomplished in the full measure desirable unless the entomologist is as much a part of the administration of the farm or plantation as the cultivator himself, and such close contact cannot possibly be achieved by the scanty staffs of Government entomologists. The function of the latter must necessarily be almost entirely advisory. The remedy lies in the employment of entomologists by plantation-owners and by associations of farmers themselves. The way has

been splendidly indicated by the Hawaiian Sugar-planters' Association, whose experiment-station staff has now won such complete control that Hawaii, in the words of the station director, has now no insect which is at present to be considered a major pest of sugar-cane. "But our existing method itself placed an obstacle in the way of such a development, for the Government Departments insisted on giving away entomological advice and assistance free of charge. Such a system not only produced very unsatisfactory results, but also prevented the public from learning to appreciate the commercial value of entomological knowledge. There was no adequate reason why a man should not pay for skilled entomological advice just as he pays for the skilled advice of the lawyer or the medical man." (Report on the Second Imperial Entomological Conference, London, 1925, p. 26.) The time is thus envisaged when associations of planters and farmers generally will employ their own entomologists. It was even suggested that some hotels might with advantage follow their example!

In connection with the Conference, trips were arranged to Oxford, Cambridge, and Rothamsted, and the thanks of the delegates must be accorded for the very full hospitality dispensed to them not only at those places but in London itself.

To conclude with a word on the scope of "economic" entomology, the present delegate would submit that no definition can be too wide, nor can the most recondite and academic investigation in entomology be characterized as useless. At the Imperial Conference, which was essentially a meeting of practical men, stress was laid heavily on the need for primary research in insect biology, rather than so-called "practical" study having for its only object immediate control. Control based on such a flimsy basis too often proves only a palliative. A few weeks after the close of the Imperial Conference, at the sessions of the Third International Entomological Congress held at Zurich, signs of a complete *rapprochement* between the applied entomologist, the academic worker, and the old amateur—to which latter class entomology is perhaps more indebted than any other science—were apparent not only in the personal attitude of the delegates, among whom professional economic entomologists were in strong force, but also in the subject-matter of the papers read.

It remains for agriculture, for forestry, and for medicine to utilize to the full the services which entomological workers, in combination, are prepared to render to human welfare.

Drugs and Instruments for Dairy Farm.—In reply to an inquiry the Live-stock Division furnished the following list of articles that would be found useful: Epsom salts, ground ginger, saltpetre, bicarbonate of soda, carbonate of ammonia, Condy's crystals, antiseptic (Kerol, &c.), raw linseed-oil, turpentine, washing-soda, mustard, vaseline, trocar and canula (medium size), teat-tubes, milk-fever outfit, funnel, and tubing.

Pasteurellosis.—This disease was demonstrated last year to have occurred among pigs on three farms in the Feilding district, where some mortality took place as a result. The outbreaks were taken in hand by the Live-stock Division, and by a process of isolation and disinfection of the sties the outbreaks were checked and no further trouble was experienced.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

RESULTS FOR THE CURRENT YEAR.

(Continued.)

L. D. FOSTER, B.Sc., Analyst, Chemical Laboratory, Wellington.

II. CHEMICAL ANALYSES.

IN any work connected with the experimental milling of New Zealand wheats chemical analyses of the flours are of value for several reasons. Of these the most important to the investigator is the bearing the composition of wheat and flour has on strength. In addition, however, analyses may be of considerable use to the miller and the baker: to the former they may suggest improved methods of handling and treatment in the mill; to the latter they may give some idea of the better results to be obtained by some slight variation in the mixing of doughs, or, later, in their fermentation.

SIZE AND SHAPE OF LOAF.

The quality or strength of a flour is judged by the size and shape of the loaf that is baked from it. The baker, of course, looks for additional qualities such as colour and texture, but the size of a loaf (its volume) may be taken as a dependable measure of its strength, provided that uniform quantities of flour, yeast, salt, and sugar are used in its making.

PROTEIN AND STRENGTH.

The strength of a flour is closely connected with the amount of protein it contains. Although there are apparent exceptions to this statement, it is a fact that if one takes a sufficiently large number of samples and eliminates as far as possible the effect of exceptions by averaging the protein content of all flours with the same baking-value it is found that good strength is associated with high protein content; and, conversely, flour of poor strength is associated with low protein content.

It may be explained here that "protein" and "gluten" are for the present purposes interchangeable terms. "Gluten" is the name given to that part of the flour which remains when the starch has been washed away. "Protein" is an inclusive name under which many allied animal and vegetable substances are grouped; gluten is one of these proteins. The amounts of gluten and protein should agree; they do agree fairly well, and for present purposes any discrepancies may be disregarded. The accuracy of gluten determinations depends on several factors which are difficult to control; the temperature of the water used, the length of time of washing, the character of the salts dissolved in the water all influence the result. The protein figure, however, may be determined by chemical means, and is the more exact.

The first illustration (Fig. 2) shows the general effect of protein content on loaf-volume. The reproduction is from a tracing of the outlines of two loaves, and represents the volumes of one of the best and one of the poorest in protein content of the flours from wheats received from the Ashburton Experimental Farm this year.



FIG. 2. SHOWING EFFECT OF PROTEIN CONTENT ON LOAF-VOLUME.

Outlines of loaves from one of the best and one of the poorest in protein content respectively of flours obtained from Ashburton Experimental Farm wheats. On left: Essex Conqueror (S 774); volume, 755 c.c.; protein, 14.69 per cent. On right: Queen Fan (S 766); volume, 570 c.c.; protein, 10.31 per cent.

Where the protein content of a flour fails to give a fair indication of the loaf which may be baked from it one may look to the *quality* of the gluten as a possible source of the trouble. The amount of gluten (or protein) may be quite satisfactory, but if its quality is below the average, then that flour will fail to make a good loaf. A separation of the gluten is therefore useful, since it enables one to examine its physical state and so gain some idea of its strength, &c. The difference in appearance between glutes obtained from weak and strong flours is indicated in Fig. 3.

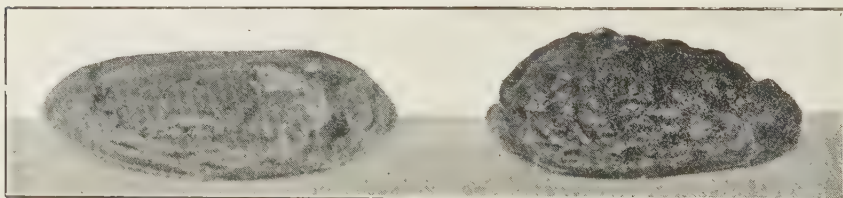


FIG. 3. ILLUSTRATING THE QUALITY OF GLUTEN.

The weak gluten, on left, possesses poor cohesion and elasticity, and has flattened out on warming. The strong gluten, on right, possesses good cohesion and elasticity, enabling it to retain its ball-shaped form on warming. Actual size.

[Photo by F. T. Leighton.]

HARD AND SOFT WHEATS.

In this connection it may be noted that wheats may be divided roughly into two classes. "Hard" wheats, as the name implies, are hard in texture and generally horny and translucent when broken across the grain; they usually produce flours of good strength, high in protein content, and baking into loaves of good size, shape, and texture. "Soft" wheats, on the other hand, are floury in texture, produce as a rule flours lacking in strength, lower in protein content, and making smaller loaves.

The truth of this statement is shown in Graph 1, which illustrates the comparative volumes of the loaves obtained from the reputedly hard and soft varieties tested this year containing over 10 per cent. protein. The general tendency of hard wheats to produce larger loaves than soft wheats is clearly indicated



GRAPH 1. VOLUMES OF LOAVES OBTAINED FROM HARD AND SOFT WHEATS.

The hard wheats show a decided tendency to produce loaves of good volume. Soft wheats are not so consistent in this respect. These samples all contained over 10 per cent. of protein, and are arranged in each series in order of decreasing protein content from left to right. The names of the hard wheats are Yeoman (S 775), Marquis (S 769), Velvet (S 771), Velvet (S 773), Velvet (T 37), Marquis (T 50), and Red Fife (S 777); the soft wheats are Essex Conqueror (S 774), Scandinavian (S 779), Snowdrop (S 772), White-straw Tuscan (S 770), Hybrid W (S 778), Zealand (S 776), Queen Fair (S 767), Major (S 760), Jumbuck (S 768), College Hunter's (T 75), Queen Fan (S 766).

From the foregoing considerations it will be seen that the percentages of protein give a certain amount of information as to the strength of flours, and are the most important figures in the main table of results accompanying this article (Table 5). In addition to these, however, other results possess a certain significance, and a brief description will be given of the importance that can be attached to them.

MOISTURE.

New Zealand wheats produce flours which are very constant in moisture content, rarely varying beyond 13.5 to 15 per cent. The amount of moisture present is to a certain extent connected with the percentage absorption of water (see below). Other things being equal, the more moisture flours contain the less water will they absorb when being made into a dough. In another respect, too, the amount of moisture must be watched, because of the bearing it has on the keeping-qualities of the flour. Too much moisture provides moulds and bacteria with an environment in which they can thrive and multiply. Naturally, the less moisture there is present the greater is the freedom from this kind of contamination; a safe maximum is about 14 per cent. of moisture.

ABSORPTION OF WATER.

The percentage absorption of water gives an idea of the amount of water which will be taken up in mixing the dough. A flour absorbing a large amount of water generally produces a loaf which is more palatable, more nutritious, and larger in volume than a flour with a poor percentage absorption. In addition, a flour with a large absorption naturally makes a larger weight of bread (a greater number of loaves). From the bakers' point of view this is of considerable importance.

RATIO OF WET TO DRY GLUTEN.

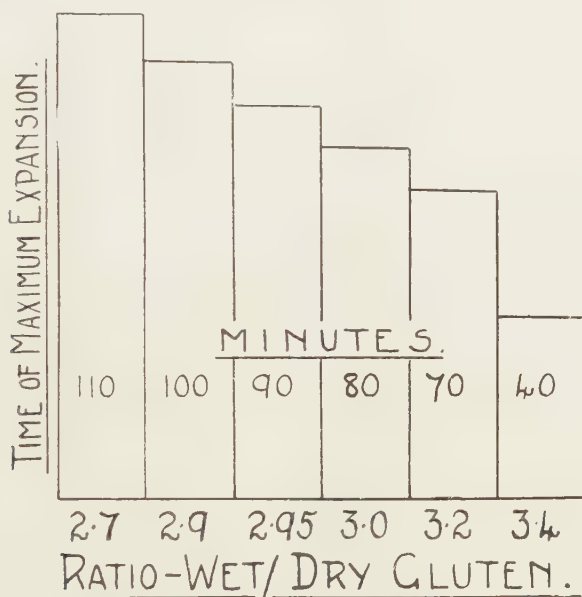
To the baker the ratio of wet to dry gluten may indicate approximately the strength of the flour and its probable behaviour during fermentation. A flour of good strength will generally have a ratio of from 3.0 : 1 to 3.1 : 1. With a higher ratio the flour tends to become weak and will not stand much fermentation. A flour with a ratio of 2.9 : 1 to 3.0 : 1 will contain a good elastic gluten, and will generally give good results in the bakehouse. Below these figures the gluten tends to become tough, and the dough needs fairly strong treatment to soften the gluten sufficiently for good results. A flour with a ratio below 2.7 : 1 must be viewed with suspicion, as it will probably contain gluten of poor quality and will not make a good loaf.

Table 3 illustrates the connection between the ratio of wet to dry gluten and the time of maximum expansion during fermentation (first rise). These figures were obtained by observing the time taken by the doughs to reach their maximum volume during the first rise; the flours were then arranged according to the times they had taken, being grouped into series differing by ten minutes in time of expansion. The averages

of the ratios of wet to dry gluten were then calculated, the following figures being obtained :—

Table 3.						Time of Maximum Expansion during Fermentation. (First Rise.) Minutes.
Ratio Wet/Dry Gluten.						
2.7	: 1	..	..	..	..	110
2.9	: 1	..	..	..	..	100
2.95	: 1	..	..	..	..	90
3.0	: 1	..	..	..	..	80
3.2	: 1	..	..	..	..	70
3.4	: 1	..	..	..	..	40

These results are shown diagrammatically in the following graph :—



GRAPH 2. SHOWING THE CONNECTION BETWEEN "TIME OF MAXIMUM EXPANSION" DURING FERMENTATION AND THE RATIO OF WET TO DRY GLUTEN, AS DETERMINED ON THE SAMPLES OF FLOUR MILLED IN 1925.

ASH.

The percentage of ash is a guide to the grade of the flour and to the degree of completeness of the milling. The following figures show the percentages of ash usually found in the different grades of flour :—

Table 4.				Ash. Per Cent.
Patent flour (90 per cent.)	..	..	..	0.42-0.48
Straight patent	..	..	..	0.48-0.54
Straight grade ..	..	..	..	0.54-0.61
First clear ..	..	..	..	0.61-0.66
Second clear ..	..	..	..	0.66-0.75
Low-grade clear	..	..	..	0.75-0.90

These flours, milled experimentally, are all straight-grade flours, and with few exceptions their ash figures fall within the limits set for this grade. Durum wheats are known to be high in ash content, and those examined this year also show this characteristic.

The flours in Table 5 in this series are arranged in order of the quantity of the protein which they contain. At the same time due consideration must be paid to the *quality* of the gluten, for, however high the protein content is, if it is poor in quality the flour will fail to produce good bread. In Table 5 quality is considered from the observed physical state of the different glutes on washing, their cohesion, elasticity, and colour. This method has certain limitations, but serves at least as a useful guide, especially on fresh flours such as these experimental samples. Two chemical methods of determining quality will be considered in a later paper.

NOTES ON RESULTS PRESENTED IN TABLE 5.

The wheat variety with the highest protein content of the 1924 samples was a sample of Durum, with 11·81 per cent.; its absorption figure was good, but the percentage of ash was very high for a straight-grade flour. The quality of the gluten for this flour, however, was distinctly poor; in colour the flour was a dark cream. This is all in keeping with the general characteristics of Durum wheats; the flours from them are decidedly yellow in colour, and have a sugar content much above the average, being for this reason useful for blending with flour low in this respect. The percentage of ash is high, though this is said to have no effect on the baking-qualities. Their strength is generally considered to be poor, but now that methods of conditioning these wheats are better understood improvement has been made in this direction.

Central Otago Wheats.

The rest of the 1924 samples came from Lake and Vincent Counties. S 709 (Tuscan) contained a good amount of gluten (or protein) of poor quality; its absorption-of-water figure was good. S 712 (Tuscan) contained a medium amount of protein, but this was good in quality. The rest of these Central Otago samples were low in protein content, but without exception the quality of the gluten was good and well above the average of samples tested this year. These flours would consequently be expected to produce loaves better than the amounts of protein indicated. They were also characterized by absorption-of-water figures well above the average, S 711 and S 710 being particularly good.

Canterbury and Southland Wheats.

Essex Conqueror topped the 1925 samples with 14·69 per cent. of protein. This variety was also the best in protein content of the miscellaneous wheats examined in 1924; it then contained 15·13 per cent. The quality of the gluten in the 1925 sample was only medium, but, notwithstanding this, Essex Conqueror would be expected to produce a loaf better than the average. The next sample, Yeoman (S 775), contained a very good amount of protein (14·19 per cent.) of fair average quality; it appeared to be a good strong sample, quite in

Table 5.—Chemical Analyses.

Laboratory No.	Variety.	Where grown.		Calculated Weight per Bushel.	Flour.	Moisture.	Absorption of Water.	Gluten, Wet.	Gluten, Dry.	Ratio of Wet to Dry Gluten.	Protein (N. x 6.25).	Ash.	Colour of Experimental Flour.	Quality of Gluten by Appearance.
		Locality.	County.											

<i>1924 Wheats.</i>														
				lb.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.		
S 392	Durum	"	"	66.8	75.4	13.94	56.0	32.17	11.53	2.80 : 1	11.81	0.87	Dk. cream	Poor.
S 709	Tuscan	Arrowtown	Lake	66.2	72.7	13.48	54.2	33.98	11.56	2.94 : 1	11.75	0.61	"	Fair.
S 712	"	Gibbston	"	67.8	73.7	13.25	53.2	24.85	8.70	2.86 : 1	9.38	0.59	Good	Good.
S 708	"	"	"	66.4	72.6	13.51	53.6	20.74	7.72	2.69 : 1	8.69	0.62	Poor	"
S 711	"	Arrowtown	"	66.4	71.2	13.58	56.2	22.50	7.93	2.89 : 1	8.56	0.49	Good	"
S 710	"	Miller's Flat	"	66.0	73.7	13.32	56.6	22.52	7.61	2.96 : 1	8.50	0.54	"	"
S 713	Hunter's	Tarras	Vincent	62.6	72.3	13.02	50.8	18.19	6.49	2.80 : 1	7.69	0.54	White	"
S 714	Velvet	Ardgour	"	63.8	74.4	13.11	54.6	17.74	6.43	2.76 : 1	7.19	0.49	"	"

<i>1925 Wheats.</i>														
				lb.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.		
S 774	Essex Conqueror	Ashburton	Ashburton	63.0	75.1	13.74	51.4	45.32	13.91	3.26 : 1	14.69	0.63	Medium	Medium.
S 775	Yeoman	"	"	63.0	74.2	13.55	48.0	49.34	14.98	3.29 : 1	14.19	0.63	"	Fair.
S 769	Marquis	"	"	66.8	70.0	13.62	49.6	43.87	14.20	3.08 : 1	13.75	0.38	Good	"
S 779	Scandinavian	"	"	59.4	73.3	13.41	48.2	43.68	13.43	3.25 : 1	13.75	0.56	Dk. cream	Medium
S 771	Velvet	"	"	67.2	74.3	13.49	50.0	43.78	12.93	3.39 : 1	13.56	0.56	Good	Fair.
S 772	Snowdrop	"	"	61.6	73.5	13.40	47.6	45.59	13.72	3.32 : 1	13.50	0.53	"	Medium.
S 770	White Tuscan	"	"	65.0	73.6	13.49	49.8	39.75	11.97	3.32 : 1	12.25	0.56	"	Fair.
S 778	Hybrid W.	"	"	64.7	73.4	13.71	47.6	35.74	11.28	3.17 : 1	11.88	0.57	Fair	Medium.
S 773	Velvet Ngapara.	"	"	65.4	76.2	13.66	50.8	36.21	11.61	3.12 : 1	11.88	0.56	Good	Fair.
T 78	Durum	Hinds	"	65.8	69.1	13.69	51.6	38.10	12.21	3.12 : 1	11.81	0.70	Dk. cream	Medium.
S 776	Zealand	Ashburton	"	69.4	77.0	13.61	50.4	31.09	10.43	2.98 : 1	11.63	0.51	"	"
S 767	Queen Fair	"	"	67.2	71.7	13.62	52.8	38.16	11.64	3.28 : 1	11.31	0.63	Good	Fair.
T 37	Velvet	Lincoln	"	68.0	71.1	14.29	50.0	34.56	10.64	3.25 : 1	11.13	0.45	"	"
T 50	Marquis	Gore	"	66.4	70.6	14.07	54.4	32.25	11.00	2.93 : 1	10.88	0.62	Dk. cream	"
S 768	Major	Ashburton	"	65.4	72.0	14.35	50.0	35.95	10.97	3.28 : 1	10.75	0.59	Good	"
S 765	Jumbuck	"	"	66.4	71.7	13.86	60.8	31.66	10.30	3.08 : 1	10.69	0.59	Medium	"
S 777	Red Fife	"	"	67.6	72.0	13.67	51.6	27.23	9.85	2.76 : 1	10.56	0.52	Good	Good.
T 75	Queen Hunter's	"	"	67.2	73.4	14.00	51.4	28.53	9.31	3.07 : 1	10.31	0.48	"	Medium.
S 766	Queen Fan	"	"	66.4	72.3	14.10	48.8	27.33	10.05	2.72 : 1	10.31	0.64	"	Fair.
T 77	Solid-straw	Gore	"	68.0	71.7	13.80	52.4	28.52	9.54	2.99 : 1	9.69	0.49	"	"
T 51	Major	"	"	64.7	70.8	14.13	55.2	27.31	8.73	3.13 : 1	9.63	0.56	Medium	Medium.
T 52	Solid-straw	"	"	64.4	69.3	14.22	54.4	28.62	8.96	3.20 : 1	9.44	0.54	Good	Fair.
T 76	Velvet	Ashburton	"	67.6	72.3	13.46	51.8	26.59	8.34	3.19 : 1	9.25	0.51	"	"
T 101	Hybrid W.	Horrelville	Eyre	65.8	77.3	14.14	49.4	25.29	8.32	3.04 : 1	8.75	0.56	White	Medium.

keeping with the reputation this variety has gained in England. A sample of Marquis (S 769) was nearly as good (13.75 per cent.); last year a sample from the same locality contained 13.80 per cent. Scandinavian, a wheat of mealy texture, contained a very good amount of protein which was only medium in quality; this sample was low in its calculated weight per bushel. The best sample of Velvet received was S 771, with 13.56 per cent. protein; this was of average quality, but the ratio of wet to dry gluten was rather high; this sample would prove rather quickly. Snowdrop (S 772) was rather low in its absorption-of-water figure; it was a very good wheat as regards its protein content, though the quality of its gluten was only medium. The above may be classified on their protein content as very good wheats.

A sample of White Tuscan (S 770) was a good wheat. Hybrid W (S 778) and Velvet Ngapara (S 773) were much about equal, though the Velvet contained a rather better quality of gluten. The Durum wheat from Hinds contained a good amount of protein of medium quality; its ash was high. Zealand (S 776), with the highest calculated weight per bushel and an excellent yield of flour, contained a good amount of gluten of medium quality; the colour of this flour was a dark cream. Queen Fair (S 767) was a good wheat, and Velvet (T 37) much about the same. The sample of Marquis (T 50) from Gore contained a good amount of protein, and possessed a capacity for water above the average (54.4 per cent.). In quality this was the best of the Southland samples. Major (S 768) was a good wheat. Jumbuck (S 765) was marked by an excellent capacity for water (60.8 per cent.). Red Fife (S 777) contained a good amount of protein the quality of which was well above the average; this should be a better wheat than the amount of protein indicated.

The remainder of the samples may be classified as medium samples, with the exception of Hybrid W., which was poor.

VARIETIES AND LOCALITIES.

The samples from the Central Otago district were not characterized by high protein content, but they possessed in every case but one gluten of a quality above the average. On a basis of protein content they do not therefore show to advantage; the quality of the gluten would, however, more than compensate for what they lack in quantity. The two samples from Vincent County were low in protein, but this was above the average in quality.

The best of the Southland wheats was a sample of Yeoman—a good medium-strong wheat; all Southland samples showed, however, an absorption-of-water figure well above the average. The remainder of the wheats tested were grown in Canterbury, and the bulk of these at Ashburton. The Ashburton samples showed the very good average this year of 12.04 per cent. protein; last year the average was 12.96 per cent. Essex Conqueror, for the third year, headed the list of the miscellaneous samples from Ashburton. Other undoubtedly good samples this year were Yeoman and Marquis. The absorption-of-water figure for these samples was generally on the low side, Jumbuck being a notable exception.

SUMMARY.

Very few of the better-known varieties were received for testing during the autumn of 1925.

Only a few samples of Velvet were received, but they maintained a good average. The miscellaneous varieties were again remarkable for their average very good strength. With very few exceptions they were grown at the Ashburton Experimental Farm; this is the second year in which the Experimental Farm samples have been noteworthy in this respect. The following may be classified, on their protein content, as strong wheats: Essex Conqueror, Yeoman, Marquis, Scandinavian, and Snowdrop. Seven are, on this basis, medium strong wheats: Hybrid W, Zealand, Queen Fair, Major, Jumbuck, and Red Fife.

Again no correlation was found between calculated weight per bushel and protein content.

(Series to be continued.)

ALBANY EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1924-25.

C. J. HAMBLYN, B.Ag., Assistant Instructor in Agriculture, Auckland.

THE season of 1924-25 was a comparatively favourable one for this gum-land area. An early spring followed by a summer of good rainfall gave the crops and pastures a good start. A long dry spell in the autumn checked growth somewhat, showing, however, to advantage the drought-resisting qualities of paspalum and kikuyu among the grasses, and of chou moellier, Japanese millet, and, to a lesser extent, mangolds among the fodder crops.

The crops as a whole, in spite of the favourable season, were poor, due largely to the ravages of small birds—which find secure shelter in the numerous hedges—to fungoid and insect pests, and to weeds, including twitches of various kinds and sorrel, with which the land, through continuous cultivation, has become very foul. In general, the work on the area was confined to demonstrations of root, fodder, and special crops, while, in pursuance of the policy outlined in the report on the area for 1923-24 (*Journal*, November, 1925), three new plots have been put down in permanent-pasture mixtures for demonstration purposes under grazing conditions. The reduction of the cropping area has enabled the limited labour strength to cope more successfully with weeds and to give the necessary cultivation to the crops.

A useful exhibit of root and fodder crops was made at the Albany Fruitgrowers' Association Show, and was appreciated by farmers and others present.

CROPS.

Mangolds.—This crop has consistently done well at Albany. A small area of Jersey Queen was sown early in November, 1924, and

three methods of applying the fertilizer were again tested: (a) broadcasted immediately before sowing; (b) side-drilled 2 in. to one side of the seed; (c) mixed and sown with the seed. The strike and early vigour of the young plants were appreciably better where the seed was mixed with the manure even a week before sowing. There was no indication that side-drilling the manure gave better results than broadcasting.

Swedes and Soft Turnips.—The same fertilizer-application test as with mangolds was tried with swedes and soft turnips. In both cases where the seed was mixed with the manure (3 cwt. superphosphate and $1\frac{1}{2}$ cwt. blood-and-bone per acre) before sowing, the germination was poor and resowing was necessary. The strike with both the broadcasting and side-drilling methods was good. Turnip "fly" in the early stages of growth and dry-rot later caused much damage to the crop.

Chou Moellier.—A small area of chou moellier was sown in November. The crop was badly attacked by cabbage-aphis in January and February, when practically all the leaves were stripped from the plants. A good recovery was made, however, and the crop stood the dry conditions well. The plants were cut and fed to the stock, giving in two cuts a good yield of forage.

Potatoes.—A further test was made with a blight-resistant strain from Mr. S. Bilkey, Taupiri, and sufficient seed saved to sow a larger area. The strain was free from blight, which slightly attacked neighbouring rows. A number of selected English and American varieties were grown with a view to obtaining sufficient seed for further testing. Several of the varieties give indications of being good croppers. Potatoes, however, have generally given poor results at Albany, the soil being unsuitable for this crop.

Artichokes.—An area of $\frac{1}{2}$ acre was planted in Jerusalem artichokes, at the rate of 5 cwt. seed tubers per acre, with 3 cwt. of superphosphate and $1\frac{1}{2}$ cwt. of blood-and-bone manure per acre. The crop, the seed of which was ploughed in at the end of September, grew well, and yielded when dug for seed in September of this year 1 ton of tubers—that is, at the rate of 8 tons per acre. In view of the fact that the demand for artichokes for seed is rapidly increasing, this would be a payable crop on small areas in the district. From £8 to £10 per ton was offered by merchants for seed.

Cabbages.—This crop has each year given a good yield at Albany. Cabbages are easy to grow, resist drought, and provide excellent winter feed for dairy stock. It has been demonstrated that on gum-land soils cabbages can be grown to advantage for autumn and winter feed.

Japanese Millet and Red Clover.—A plot was sown at the rate of 12 lb. millet and 6 lb. red clover per acre early in November, and cut for hay in January. This makes an excellent crop for feeding off by dairy cows. The red clover grows well with the millet, and the crop can be used for hay; while the red clover provides excellent autumn and winter feed, and if top-dressed can be cut for hay the following season.

Japanese Millet and Crimson Clover.—This crop was sown at the same time as the millet and red clover, but the crimson clover was much slower in growth and did not combine well with the millet.

Maize and Peas.—A small area of maize and field-peas was tried. The peas grew well and climbed freely, the combination forming excellent forage for pigs, and, when cut and fed out, a better ration for dairy cows than maize alone.

Maize and Vetches.—This combination was also tried, but owing to the slower growth of the spring-sown vetches they were rapidly smothered and did not combine with the maize as well as the field-peas.

THE ORCHARD.

The orchard was sown half in blue lupins, at the rate of 3 bushels per acre, and half in *Lotus hispidus*, at 20 lb. per acre, at the end of September. Both crops were ploughed under for green manure in the autumn, the blue lupins giving the greater yield of green material for the purpose.

PASTURES.

Top-dressing Trials on Showground.—Satisfactory arrangements could not be made for the weighing of the plots on the Albany showground. This year the whole area has been top-dressed by the lessee, and the plots must now be abandoned. Although weighings have not been made on these plots, great interest has been taken in them by local farmers, and the efficacy of phosphates and lime in promoting clover-growth and improving a poor brown-top-danthonia-paspalum pasture has been clearly shown.

Cemetery Reserve.—This reserve of 3 acres has been leased for the purpose of supplying extra feed for the three heifers bought during the year to graze the grass-plots. The pasture consisted mainly of brown-top and suckling-clover. The area was top-dressed with 3 cwt. superphosphate per acre in the autumn, and a marked improvement is shown in the pasture. White clover, cocksfoot, and perennial ryegrass are already showing up, and the colour and growth of the pasture are improved.

Kikuyu and Paspalum.—This area was surface-sown with a mixture of clover (red clover, 2 lb.; *Lotus major*, 1 lb.; and subterranean clover, 1 lb. per acre) in September, 1924, but so far with no success. The paspalum among the kikuyu is still confined to the original plants, and has been prevented from spreading by the stronger growth of kikuyu.

Kikuyu and White Clover.—This plot was top-dressed with 3 cwt. per acre of basic superphosphate in September, 1924, and a marked improvement was shown in the growth of the white clover, which is spreading rapidly. The plot is now better grazed, and is in marked contrast to the adjoining kikuyu-plot in which there is no clover.

Kikuyu and Lotus Major.—The *Lotus major* continues to thrive among the kikuyu, and the two are readily eaten by stock. *Lotus major* has so far proved to be the best legume to combine with kikuyu. The plots without a legume (either a *Lotus* or clover) demonstrate clearly the value of a nitrogen-gathering plant in promoting the growth of kikuyu. When closely grazed, and especially when grown with *Lotus major* or white clover, the kikuyu-grass was a favourite with the stock, and provided feed from early October until the first winter frosts.

Over fifty packages of kikuyu-plants have been sent out to farmers for planting, and many are extending their areas in this grass.

White-clover Trials.—Three types of white clover—English wild white, Dutch white, and New Zealand wild white—were sown in separate plots with a mixture of English grasses in the spring of 1924. Inspections were made periodically throughout the year, and the differences in growth and habit observed.

The English wild white was slow to start away, and covered the ground slowly. This spring the growth has been more rapid. Stock showed preference throughout for New Zealand wild white, which was kept more closely grazed.

Dutch white, being more upright in growth, covered the ground very slowly, and when grazed the tips of the creeping stems were frequently eaten off, causing a check to the plant. It is a larger clover than the other two. The stock neglected this clover, which came into flower quite early.

New Zealand wild white gave a better germination than the others, and covered the ground rapidly. The stock grazed this plot closely. The indications are that New Zealand wild white provides a quicker and better ground-cover than either English wild white or Dutch white clover.

Paspalum and Subterranean Clover.—A small plot was sown with a grass mixture including paspalum and subterranean clover in September last. The subterranean-clover plants were freely eaten by birds while in the cotyledon stage. The plants that survived spread rapidly, and this spring gave a good growth. So far very little paspalum has shown up, and it would appear that the subterranean clover, *Lotus major*, and *Lotus hispidus* have smothered out many of the young paspalum-plants, which do not tolerate shade.

Cocksfoot Trials.—With a view to testing a selected strain of Danish cocksfoot against Akaroa cocksfoot an area was put down this spring in a mixture of English grasses and divided into six plots. On three of these the Danish strain was sown at the rate of 12 lb. per acre, and on the other three selected Akaroa seed at the same rate. The strike in both cases, owing to the late spring, has been fair only.

GENERAL.

As already indicated, owing to the depredations of small birds, the damage done by fungoid, insect, and other pests, and to the increase in weeds, such as twitches and sorrel (despite steady effort with hoe and cultivator), cropping at the Albany Area is difficult and uncertain. Real experimental work is now not feasible, on account of previous differential treatments of the soil, which latter has largely been converted from the original gum-land clay of better quality to a fair clay loam. The work has therefore to be limited mainly to demonstration, and for this purpose grass mixtures are being made increasing use of.

Shearers' Accommodation.—Inspection duties under the Shearers' Accommodation Act are now carried out by the Live-stock Division of the Department of Agriculture. Inspectors have already been able to bring about considerable improvements where necessary, and further work is in hand.

UNIVERSITY EDUCATION IN AGRICULTURE.

VIEWS OF ROYAL COMMISSIONERS.

Extract from report of Royal Commission—SIR H. R. REICHEL, Wales, and FRANK TATE, Victoria—on University Education in New Zealand, presented to Parliament during session of 1925.

NOTHING illustrates better the difficulties incidental to the building-up of a sound scheme of higher education in a country with the geographical configuration and the distribution of population of New Zealand than the present position with regard to agriculture in the University. The prosperity of the Dominion rests upon its rural industries, and with the classical example of their great rival, Denmark, before them one would have expected the New-Zealanders to have imitated Denmark in making the scientific education of the staff and intelligence officers of the agricultural army a most important branch of university work. In Denmark during the past fifty years there has been a remarkably close alliance between the trained men of science and the great producing interest on which the national prosperity depends. The names of Fjord and Segelcke, among many others, are held in great honour among the Danes, for these men did notable pioneer work in bringing scientific methods into the daily routine of the farm and butter-factory. The confidence of the farmers once won has never been lost, and to-day the co-operation between University and farm is loyal and complete.

It is worthy of note, however, that Denmark was satisfied with no makeshift arrangements for the training of agricultural leaders and teachers. The Royal College or Institute of Agriculture and Veterinary Science at Copenhagen, although not a part of the University, is of university standing. It is splendidly housed, and has a staff of some forty professors, many of them—*e.g.*, Westerman and Bang—of world-wide reputation. It offers advanced courses in the various branches of agriculture, and in veterinary science, in forestry, or other allied branches of rural industry, to students who have had a full course of secondary education, and who, in addition, have had two years' practical experience on a farm. The Institute supplies the directive power behind all the agricultural activity of Denmark. It controls the arrangements, carried on at selected farms, for making economic experiments in dairying, and in the feeding and breeding of animals. It makes continuous tests of butter manufactured for export. It distributes sera and vaccines necessary for combating disease in domestic animals. It is in organic touch with the Government experts in agricultural economics. Its graduates go forth as teachers, as research station officers, as counsellors employed by the farmers' associations and co-operative societies. So great is the appreciation of the work of the scientific agriculturist that over one hundred counsellors are employed as advisers throughout the country.

It is undoubted that the greatest factor in Danish success in dairying and marketing has been skilled leadership and guidance. The country has prospered not so much because the average rural worker has been reasonably well educated, but because he has been well led and advised by men whose scientific training was the best that could

be given. The Danes have realized fully that the rank and file of agriculturists should have a good elementary education. They have made a wonderful success of their system of adult education, under which farm youths of from eighteen to twenty-five years of age attend the People's High Schools, and thereafter the People's Agricultural Schools during the five winter months, while farm girls attend the same schools during the three summer months. In this way they secure a good average of general education. But it is to trained scientific leadership that they really owe their success, and in leadership the second best cannot be tolerated.

The sustained enthusiasm and the great expenditures which have been necessary to build up such an efficient school as the Royal College of Agriculture at Copenhagen have been amply justified by the great increase in national production. The history of this school illustrates the wisdom of concentrating upon one first-class institution capable of turning out first-class graduates.

How has New Zealand faced the same problem? It has endeavoured to create a degree course in agriculture by an alliance between Lincoln Agricultural College—a school designed primarily to train practical farmers—and the neighbouring University College at Christchurch. No professor is, however, at the head of the agricultural school, and, so far as we can learn, the science subjects taken at the University Colleges are not treated from the point of view of the needs of agricultural students. No special arrangements have been made for the agricultural students during their year at the University College. They attend classes in science subjects originally planned for students of pure science, or of medicine, or of home science. Naturally, therefore, the subjects are not treated from the point of view of the agriculturist. While we agree that a wide knowledge of science is invaluable, and that a student who learns the truths of foundation sciences, such as physics, chemistry, and biology, from an inspiring teacher has gained a great asset, we believe that teaching and learning gain wonderfully in reality and interest if the matter of the teaching is related to the practical concerns of the student's future vocation. Nothing is more evident in studying the product of schools and universities than the existence of a great gap between the knowledge of a subject and the power to apply this knowledge in practical affairs. This is true of students of literature, of history, and of philosophy, and it is equally true of students of science. A good teacher finds that the greatest stimulus he can give comes from relating new truths to old truths and to practical life.

No one who reads the details of the science subjects⁷ prescribed for the first year of the course for the degree of Bachelor of Agriculture would, we feel convinced, regard them as a really good introduction to agricultural study. If they were treated as pure science there would be less objection than there is at present. The whole arrangement is a makeshift, and is quite insufficient to provide the quality of agricultural leadership the Dominion requires. The university year is followed by two years of study and practice at Lincoln College. As the amount of practical farm-work is apparently considerable, there must inevitably be a lessening of the time devoted to teaching and study. The time devoted to the degree course—three years—is in itself too short, and the emphasis laid upon farm-work increases this shortage. Moreover, the great majority of students at Lincoln College

are non-matriculated and are taking the lower course designed for practical farmers. If the teachers necessarily take both groups of students for common lectures and laboratory work, it is certain that the work must be kept at a much lower standard than degree students require. Or, alternatively, there must be a great strain on teachers and degree students in providing and receiving special tuition outside the ordinary time-table.

The course at Lincoln College is by no means adequate for a good degree course. Certainly the economics of agriculture should receive much more time and attention. If one fact stands out above another in the progress of Danish agriculture it is that every question involving changes in methods of production and of marketing has been considered in its economic aspect. A Danish "counsellor" in the employ of an association of farmers does not merely inquire into and advise as to an improved balanced ration designed to produce a greater amount of butterfat, but he goes minutely into costs and returns. The confidence of farmers will never be gained and kept until this is done by his advisers, for the farmer's problem is not merely to produce in quantity, but to produce with a satisfactory margin of profit.

Since February of this year a School of Agriculture, so-called, has been established at Victoria College, Wellington. The following evidence was given to the Commission by Professor C. F. Peren, Professor of Agriculture: "The School opened at the beginning of the present academic year with twelve students. The permanent staff consists solely of myself, but lectures are also being given by three members of the Biological Laboratory of the Department of Agriculture. At present we have neither lecture-rooms nor laboratories, such accommodation being lent to us when not required for its normal uses. We have neither land nor live-stock, and must surely constitute one of the most extraordinary Schools of Agriculture which ever accepted students. During the present year we are confining our work to those subjects which can best be taken under the present conditions, but next year the situation will be extremely serious unless we are provided with proper facilities. There are, however, only eight months before the next academic year begins, and therefore, unless action is taken almost immediately, there will not be sufficient time to make proper provision, as buildings cannot be erected and laboratories equipped in a day . . . I submit that the folly of this weakness in the system of education of an agricultural country should be strongly emphasized, and that agricultural science should be presented to those in higher quarters as a very valuable combination of science and practice, not merely as a hobby for scientists."

The Commission learns that the establishment of a Chair of Agriculture at Victoria College was not part of a well-considered scheme of agricultural education adopted by the Dominion Government, but was the result of a gift to the College of £10,000. This sum, supplemented by a subsidy from the Government, is just sufficient to provide the salary of one professor. We learn further that the Auckland University College is also the recipient of a bequest of £20,000 to enable a School of Agriculture to be established in that city, and that a professor has recently been selected. In this case also the amount is not adequate for the development of the school on satisfactory lines. Accordingly, if the present arrangements are maintained, New Zealand is committed to the maintenance of three agricultural schools within

the University, not one of which can continue efficiently without a considerable increase in the national expenditure.

The question which the Government of New Zealand must decide, and at once, is whether the example of countries which have made a success of agricultural education in its highest aspects is to be followed, and whether the principle is to be accepted that the best possible training for the future directive staff of the agricultural army is the only sound policy. Second-rate and third-rate agricultural "experts" are a hindrance and a danger to agricultural progress. New countries suffer greatly from such guidance.

A properly equipped University School of Agriculture must have a staff adequate to provide a sufficient variety of courses to produce the different specialists the country requires. But to do this efficiently involves a very heavy expenditure on staff and equipment. Taking a few well-known college courses, we find that the Macdonald College of the McGill University, Canada, employs in its School of Agriculture no fewer than thirty-two professors, lecturers, and other teachers, all of them save three being university graduates. It is true that some members of the staff take classes in the two schools associated with agriculture in the College, the School for Rural Teachers and the School of Household Science; but the fact remains that the necessities of the agricultural students demand a very complete staff of highly trained specialist teachers. The College provides agricultural courses of varying duration, that for the Bachelor's degree extending over four years.

The Ontario Agricultural College at Guelph is also one of well-established reputation. It numbers on its staff some fifty-seven professors and other teachers, the great majority of whom are employed in agricultural subjects. The College also provides a department of home economics. The purpose of this College is not to train university graduates, but "to train the young farmers of Ontario in the best practices and the science of good farming, and, secondly, to conduct experiments in all branches of agriculture, the results of which are to be published for the benefit of the farmers of the province."

It will be seen from the liberal provision of teaching staff that the authorities recognize that agricultural education that is worth while must be liberally financed.

Lastly, we quote the example of one of the many colleges in the United States, the Iowa State College of Agriculture and Mechanic Arts. Iowa is about two-thirds of the size of New Zealand and has a population of two and a quarter millions. The College offers courses in agriculture, home economics, veterinary science, engineering, industrial science, and advanced courses for graduates. Students are grouped in divisions, *e.g.*,—(1) Secondary course (three years), for those who cannot reach the standard of university courses; (2) undergraduate course (four years), for those who intend to take a degree; (3) graduate course, for training in advanced work as specialists in branches of agriculture; (4) winter short courses, for farmers and their wives and daughters. The staff comprised in 1916 some 55 professors, 57 associate professors, and 196 assistants; in all, 308 members. Of these, 54 were members of the agricultural experiment station maintained in the College. The number of students in 1916 was as follows:—

(1.) Agriculture—(a) Graduate Division, 115; (b) undergraduates (four-year course), 975; (c) secondary course (three-year course), 213;

(d) winter short courses, 2,469: total, 3,772. (2.) Home economics, 987. (3.) Veterinary science, 317. (4.) Science, 214. (5.) Engineering—(a) Undergraduate, 746; (b) short courses, 1,026: total, 1,772. Grand total, 7,062.*

Our purpose in quoting these examples is to impress upon New Zealand the necessity of facing the position and establishing one really efficient agricultural college of university standing. The attempt to maintain the three centres now in being must, in our opinion, end in failure. At best each school will be doomed to what one witness called "anæmic mediocrity."

There are certain fundamental considerations which must be kept steadily in view. To-day the subject-matter of agriculture is divided into large departments with specialists in charge of each—*e.g.*, agronomy, animal husbandry, dairying, and horticulture. It is absurd to expect one man, however well informed, to profess and to teach the whole of the work of an agricultural course. And, further, the technical subjects should not be dominated by instruction in sciences taught without regard to their application to agriculture.

We are of opinion that an agricultural college in association with the University should be established in some suitable locality in the North Island by a combination of the schools proposed for Wellington and Auckland. It should provide courses for degrees in agriculture and for post-graduate work, and, in addition, should offer such lower courses as diploma courses for farm youths and short practical courses for adult farmers. As in the American and Canadian colleges, departments of home economics and ultimately of training for rural teachers should be associated with it.

Such a college will necessarily be a residential institution, and there is no reason why it should not ultimately develop into a complete residential university grouped appropriately around the study of agriculture as its leading subject. This would be strictly in accordance with the fitness of things in a Dominion so dependent as is New Zealand upon the work of its farmers. Moreover, such a scheme, under which education in liberal studies would be associated with training in the more directly practical concerns of rural life and work, would do much to help towards the development of a culture of the country as distinct from the culture of the city. How to develop widely a taste for country life and the power of finding happiness and interest in country pursuits and in the natural life of the country is a very practical problem. Intellectual ability naturally gravitates to the quarter where it finds most scope for its powers. The modern city university thus attracts to itself like a powerful magnet the best intellect of the surrounding rural districts and converts it to urban uses. The present university system of New Zealand, if left uncorrected, must continue to undermine the basic industry of agriculture, on which the whole future prosperity of the Dominion depends, inasmuch as it tends to produce a progressive intellectual impoverishment of the countryside. Nothing can effectively stop this draining process but an institution exerting an equally strong pull in the opposite direction, such as a well-equipped university or university college with agriculture as its central subject.

* Quoted from "Agricultural Education in America," A. E. Richardson. (Government Printer, Melbourne, 1918.)

The great output of engineers, doctors, and lawyers from the university colleges is a direct result of the great facilities afforded for these courses. Why not, therefore, give bright young fellows in country schools the opportunity to become leaders in scientific agriculture and other great rural activities?

Agricultural education should be the concern of each type of school in the national scheme, and a great step forward will be taken when an efficient training for rural teachers has been developed, a training which will fit them to teach efficiently a course of study adapted to rural needs and to the interests of rural life. No better position could be found for such a training course than in association with an agricultural college of the kind above described.

As to a department of home economics and farm economics for women, we consider that provision should be made for such study from the first. The part played by the woman in rural industry is no less important than that of the man, and the State should recognize this by the provision of suitable education for her. There need be no duplication of graduate courses now provided at Otago; but good diploma courses suited for farm wives and daughters would be appreciated and would be most helpful.

RANGE OF KIKUYU-GRASS IN NEW ZEALAND.

AN Ashburton correspondent writes to the Editor:—

"A small quantity of kikuyu-roots was obtained from Sydney last spring, and about thirty plants were established in October on cultivated soil. They struck well, grew at an extraordinary rate, and the grass looked really beautiful; in fact, I thought that a grass was discovered that would be of enormous benefit to farmers on the dry plains of Canterbury. The stolons grew over 1 in. a day, and the cuttings, which were planted 6 ft. apart, were soon united in one tangled mass. My first disappointment was when, to test the palatability, a sheep was tethered on the fodder and it was found that it would not be eaten unless the sheep was really hungry. It is possible that this new feed may be distasteful at first, but would be eaten fairly readily when stock were accustomed to it. Some of the plants were fed close in this way in order to remove all the top growth before winter so that the effect of the frost would be apparent. However, the frost completely killed every plant, although the roots of many of them were well protected by the unfed dead leaves."

The Fields Division comments as follows:—

"In reference to the climatic conditions suitable for kikuyu, we have never recommended its establishment outside the Auckland Province. Our experience has been that it does not recover from severe frosts, and in general a line passing through Hamilton is about its southern limit. Farther south there have been cases where the grass has become established in sheltered situations and has been able to withstand frosts, but in general the grass is killed out during the first winter. North of Hamilton, however, reports are still favourable, and we have sent out approximately one hundred lots of roots in the last two seasons to farmers for trial. Sheep do well on kikuyu provided the usual stocking system is followed. At Puwera the area in this grass was closed up for two weeks after being grazed by cattle, and sheep were turned in on the young growth. This was eaten well down by them. Again, after the kikuyu had been cut for hay, sheep relished the aftermath, which they closely grazed."

Further information regarding kikuyu, to be gathered during the current season, will be published in due course.

HOLLY OAK'S ANNIE.

THE JERSEY CHAMPION'S RECORD.

In the October *Journal* a brief reference was made to the performance under certificate-of-record test of the Jersey cow Holly Oak's Annie, constituting a new high level for the breed in this country. It can now be recorded that she calved, subsequent to test, on 18th November, thus fully qualifying for her certificate. Holly Oak's Annie is the third New Zealand Jersey to gain a C.O.R. on a production exceeding 1,000 lb. of butterfat.

The production of Holly Oak's Annie, month by month, while under C.O.R. test is shown in the following table:—

Month.			Days.	Milk.	Test.	Butterfat.
				lb.	Per Cent.	lb.
1924—	September	..	2	82.3	5.19	4.27
	October	..	31	1,840.5	5.19	95.52
	November	..	30	1,859.8	4.95	92.06
	December	..	31	1,810.8	5.18	93.79
1925—	January	..	31	1,697.2	5.70	96.74
	February	..	28	1,448.4	5.67	82.12
	March	..	31	1,555.9	6.02	93.66
	April	..	30	1,423.4	6.23	88.67
	May	..	31	1,514.7	5.91	89.51
	June	..	30	1,419.3	6.02	85.44
	July	..	31	1,374.9	5.97	82.08
	August	..	31	1,356.2	6.03	81.77
	September	..	28	1,139.3	6.22	70.86
Totals			365	18,522.7	..	1,056.49



HOLLY OAK'S ANNIE, OWNED AND TESTED BY W. T. WILLIAMS,
PUKEHOU.

It will be observed that Holly Oak's Annie was remarkably consistent in both butterfat test and milk-production. Another point is the evidence of constitution as made apparent by the persistency of milk-flow. She was still yielding at the rate of over 40 lb. milk per day at the expiry of her 365 days on test. Her total yield for the season constitutes a New Zealand Jersey record in both milk and butterfat.

Holly Oak's Annie is a daughter of Grannie's Knight, a champion butterfat bull with some forty C.O.R. daughters to his credit. Grannie's Knight is a son of K.C.B., one of the best-known bulls of the breed in the Dominion. On the dam's side Holly Oak's Annie goes through Ancerine to Soumise Tom, a champion butterfat bull and a son of Soumise Majesty, sire of ten C.O.R. daughters. Other names appearing in the pedigree, and which speak for themselves, are Campanile's Sultan, Silver King, Fury, Monopoly, Retford Boy, and several others almost as widely known to students of the breed.

The accompanying photograph makes it clear that the new champion combines type with production, while constitution is also apparent.

—W. M. Singleton, *Director of the Dairy Division.*

INCIDENCE OF FOOT-AND-MOUTH DISEASE.

In the report of the departmental Committee appointed by the British Government to inquire into foot-and-mouth disease in Great Britain, and published earlier in the year, the following important statement occurs :—

We are bound to agree with the view that there was something in the nature of the virus met with in this outbreak to account for the large number of cases of recurring outbreaks. There is little doubt that this outbreak has demonstrated conclusively that the opinions previously held as to the normally short period for which the virus is capable of living outside the animal body must be drastically revised.

This statement strongly emphasized the necessity for even greater care than had hitherto been thought necessary. Incidentally, some confirmation of it can be found in the fact that an outbreak occurred in California in April of this year on a farm where evidently no previous cases had occurred for some months previously.

The following extract from the report of the same Committee indicates that the conditions prevailing in dairying districts in Britain were specially favourable for the dissemination of foot-and-mouth :—

It is generally agreed that the virus of disease met with in this outbreak remained active for a period far exceeding anything experienced in previous outbreaks, whilst the conditions prevailing in Cheshire were exceptionally favourable to the spread of infection. For example—(a) the heavy milking-stock carried on comparatively small contiguous grass farms ; (b) the absence of natural barriers—*e.g.*, large tracts of arable land, woodlands, hills, &c. ; (c) the necessity for daily movement of milking-stock from buildings to pastures ; (d) the necessity for daily handling of milking-stock ; (e) the visits of milkers resident away from the farms and probably keeping a few animals on their own premises ; and (f) the presence of faulty systems of drainage, and the lack of adequate fences between fields.

With the exception of (e), these conditions are also found in the dairying districts of New Zealand.

HIGH - GRADE CHEESE AND THE BRITISH MARKET.

STATEMENTS are occasionally made to the effect that the quality of cheese which has been allotted high grading-points in New Zealand does not give as much satisfaction, nor does the cheese realize as high a price, on the British markets as that which has been allotted lower points. In a recent report from Mr. Walter Wright, the Dairy Division's Inspector in London, he comments on this matter, and the following extract is quoted for general information :—

During the past few days I have interviewed the merchants who last season handled the outputs of each of the cheese-factories which last year scored the first three highest average grade points at six of the leading grading-ports. Without exception the comments of these merchants were very pleasing and encouraging. In most cases the two chief words used to express their idea of quality were "Very good." There were one or two comments regarding a little openness in the make in one or two individual factories, but all of those I interviewed on this matter were unanimous in their opinion regarding the high average quality of the cheese referred to.

The foregoing information has been from the merchants' point of view—men who have handled the goods and who are responsible for the financial returns to the dairy companies interested. My own personal opinion is an unreserved endorsement of the opinion of these people who have handled the cheese. It seems to me that adverse criticism of the grading is an endeavour to lower or depress the average quality of our cheese, simply because some of the cheese that has not scored high has probably realized on this market the same price as cheese of a higher-scoring quality. There are many factors that come into the question when the marketing of cheese is concerned. The time of arrival of the steamer, the upward or downward trend of the markets, and the season of the year are among many of the reasons that might be advanced by merchants who handle the goods. It must also be remembered that a good cheddar cheese is a good cheese the world over.

Again, I may point out that it is rather a common saying in this country that you can sell anything in the United Kingdom—good, bad, and indifferent—but at a price. This applies to the cheese-markets. There is a great variety of tastes in this country where cheese is concerned, and owing to the intimate knowledge that merchant houses have of the requirements of different districts and localities they are enabled to obtain prices that are sometimes not consistent with the quality of the goods offered. If my observations, now covering a period of several years, regarding the cheese requirements in the United Kingdom are worth anything, they have taught me that high-quality produce will always command a market at any time, no matter what the state of the market may be; and that, on the other hand, goods of inferior or indifferent quality are always difficult to sell. A brand of cheese that is well known to the trade as being of a high average quality and uniform will always be the first to be sold on a slow market, and it is on slow markets particularly that buyers become so critical in their selection of the goods most suitable for their particular trade.

As you are aware, $2\frac{1}{2}$ per cent. has been the acknowledged percentage allowed on our cheese-shipments for shrinkage. This allowance originated at a time when we were making a firm, normal cheddar cheese, and was found to be sufficient to meet trade requirements. To-day, however, the position has become somewhat altered. A week or two ago this matter was discussed between the head of one of the leading importing houses and myself, and the statement was made to me that to-day it is estimated that a percentage shrinkage allowance of $3\frac{1}{2}$ per cent. is required to cover the losses entailed before the goods are passed on to the retailers. Has this increase in shrinkage been brought about, to any extent, through the endeavour to make a softer or weaker-bodied cheese containing a higher percentage of moisture? Probably this is a feature of the trade that has been overlooked by the advocates of increased water content in our cheese.

—Dairy Division.

CONDITION OF HIDES.

LOSSES BY FAULTY BRANDING AND FLAYING, AND HORNING.

THE accompanying photographs will convey to those interested in the raising of cattle the widespread damage done to hides by faulty branding, by horning, and by the inexperienced or careless use of the knife in removing the skin from the beast. Fig. 1 illustrates a case where the point of the knife has so damaged the hide as to have spoilt practically half of it. Fig. 2 shows a brand that has been burnt into the hide—not only in an unnecessarily cruel manner, but also into the best part, which is used for making sole leather and belting—ruining the hide so far as its utility for these purposes is concerned. Figs. 3 and 4 show the serious results to the hide of allowing cattle to carry horns instead of being dehorned.

In 1924 there were produced in New Zealand some 593,000 ox and cow hides, also approximately 870,000 calf-skins. A proportion only of the calf-skins were branded, but in a number of cases the yearlings and vealers were more or less gored. It will thus be seen that many thousands of pounds are lost every year to the producers owing to lack of attention to proper flaying and branding. Corresponding loss is also suffered by our hide-export trade and leather industry.

Great improvements have been introduced of late for the mechanical flaying of hides where considerable numbers of cattle are treated. In correspondence with the New Zealand Tanners' Association, the Imperial Cold Storage and Supply Company of South Africa mention that they have had successfully installed and operated an electrical flaying-machine, with the result that better flaying alone has meant from their own killings 1d. per pound advance in the value of the hides—equal to 4s. to 6s. per hide in mature cattle.

With a view to eliminating as much as possible in New Zealand the losses referred to, the New Zealand Tanners' Association has approached the Department of Agriculture for assistance in securing the passage of legislation with regard to branding and dehorning, to the following effect:—

(1.) The mark shall be permanently applied to the skin. In the case of cattle, the branding shall be not less than 2 in. in height and not more than 6 in. in width, and shall be applied by being burnt into the skin only on the shoulder or neck by a branding-iron, or in such other manner as may be prescribed.

(2.) It shall be compulsory, on and after a date to be decided on, that all calves born, if not registered pedigree cattle, shall be dehorned.

In reference to the first clause, it may be explained that the shoulder and neck are of much less value in the leather than the rump. Figs. 2 and 4 show the most valuable part of the hide. As regards the second clause, it should be mentioned that horn-suppression in young calves and dehorning of older cattle (other than stud beasts) have been strongly advocated by the Department of Agriculture for a number of years past.

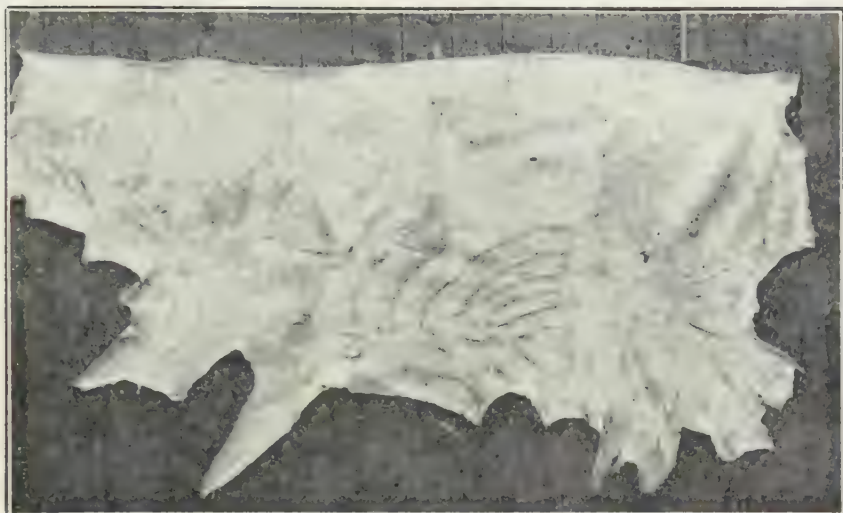


FIG. 1. A BADLY FLAYED HIDE, PRACTICALLY HALF HAVING BEEN SPOILT BY THE POINT OF THE KNIFE.



FIG. 2. SHOWING A FIREBRAND APPLIED ON THE RUMP—THE MOST VALUABLE PART OF THE HIDE.



FIG. 3. HIDE QUITE SPOILT BY HORN-MARKS.



FIG. 4. HORN-SCRAPES SPOILING A. OTHERWISE GOOD UNBRANDED HIDE.

SEASONAL NOTES.

THE FARM.

HARVEST.

THE season being late, harvesting operations will not be so general as usual during January. In Canterbury, however, wheat cutting and stooking will form the chief agricultural work. Barley will also be ready, and late oat crops may yet be standing. The time for cutting wheat should be given greater attention. Loss frequently takes place by crops being cut when the nodes on the stems are still green, and in other cases through the crop being allowed to get too ripe, when a good deal of shaking takes place. The former is the lesser evil of the two, for shaken grain is a complete loss, whereas a bushel or two per acre lost through early cutting often gives some compensation in the sample being thin-skinned and consequently attractive to the miller. It is often assumed that Velvet wheat shakes badly, and in a measure it does, but College Hunter's is certainly no better in this respect. It is best to keep stooks on the moderate side as regards size, from eight to ten sheaves being usually ample. The material then dries quickly, and may be either stacked or threshed out of the stook much sooner. This is specially important where the weather is unreliable.

Plains cocksfoot, where grown for seed, will be ready for threshing during the coming month, and should, where possible, be threshed out of stook, as shaking occasions heavy loss. Cocksfoot should be cut on the early side, so to avoid the seed-sample containing too many husks and kernels.

It is generally an indication that a white-clover stand is ready to cut for seed when the stalks begin to lean over at an angle of 45° . It will be found that at this stage the seed is set. Cutting should be done in the opposite direction to the inclination of the clover-stems. On one well-known make of mower there is an adjustment for lengthening the reach of the spring. This allows the knife to fall lower. As the clover is frequently short the knife should be kept as close to the ground as possible.

Crops of seed-peas, either of the long-strawed or medium-strawed varieties, provided the crop is thick enough, may be advantageously harvested with the mower fitted with special steel bands which trail behind and roll the peas to one side. This method is less wasteful than that of the mower and hay-rake. Another system of harvesting is by using the side deliverer. Peas should be well fielded before stacking, but not so long as to allow the pods to split open and shed their seed. Peas are generally right for putting into the stack when only about one-third of the pod appears green, the rest being dry. Pea stacks should be covered or thatched as soon as possible after building, as the straws do not easily turn the rain. Tares may be harvested in practically the same way as peas, the best method being with the mower-bands.

FEEDING OF FORAGE CROPS.

Early-sown crops of millet and rape should be ready for feeding towards the end of the coming month. To get the best out of millet,

feeding should start when it is 6 in. to 8 in. high. If this is done it will stool out and give a lot of feeding during the autumn, and stock will do better on it. Rape, on the other hand, should be allowed to ripen before being stocked. When the leaves take on a bluish tinge it is about right, although if urgently required it may be fed earlier.

Lambs confined on rape are inclined to scald, and, where possible, they should have access to some other fodder. If available, millet is very suitable for this purpose. The alternative is a run-off on grass or clover.

If rape or turnip crops are being badly attacked by aphids or moth it is good practice to feed the leaves off quickly with lambs or other suitable stock, and thus starve out the pest. The subsequent growth is then usually fairly clean.

Dairymen careful of their reputation at the factory will see that any turnips they may be feeding to their cows are allowed to wilt at least twenty-four hours. The feeding-out should be conducted in a systematic manner, the roots being scattered lightly in long lines across the field, at intervals sufficient to minimize "hunting" by the dominant cows of the herd, yet close enough to ensure a covering of the field with dung. As soon as the roots are cleaned up, the cows should be turned on to a clean uncontaminated pasture. Much of the taint in milk is undoubtedly due to the fact that cows are often allowed to remain on the same befouled pasture, where they lie down to ruminate, and so contaminate the belly and udder with the turnip refuse. This means evil-smelling cattle and a shed reeking of turnips, with the natural result of the odours being taken up by the warm, freshly-drawn milk. As soon as the field has been well dunged it should be harrowed, shut up, and a fresh growth of grass allowed to come away.

WINTER AND SPRING FORAGE CROPS.

Where the sowing of turnips and swedes has not been completed by the end of the year this work should be pushed along if the weather is favourable. On the higher situations and where the rainfall is good sowing may continue right up to the end of January, but in most places it will be found more profitable to sow turnips than swedes after about the third week of that month, as they come on quicker and the chances of a good crop are greater. Hardy or Imperial Green Globe are suitable turnips for January sowing. If any later, better results will be obtained from White Stubble. The land should be worked to a fine tilth to ensure moisture for a rapid germination. Super or basic super, at $1\frac{1}{2}$ cwt. to 2 cwt. per acre, are suitable fertilizers. If more than these quantities are being used at this season (particularly if the ground is dry) it is best to broadcast half of the material and harrow in, sowing the remainder with the seed. If large quantities of fertilizer are applied with the seed in dry, warm weather there is a danger of it having a detrimental effect on the germination.

In Southland and south Otago crops such as chou moellier, thousand-headed kale, and cabbage are generally sown before the middle of the coming month. A usual seeding is 10 oz. to 16 oz. per acre, in ridges 28 in. wide; manuring, a mixture of 1 cwt. superphosphate and 1 cwt. ground rock phosphate. Chou moellier is of great value as a winter forage, the fact that it grows well

on club-root-infected soil being of importance. It stands frost well, does not taint milk, and has a very robust habit of growth. It is thinned out eventually to about 12 in. apart, with either the hand or horse hoe. The land intended for such forage crops should be well worked, so as to encourage rapid growth.

The end of January is about the best time of the year to sow Western Wolths rye-grass for winter and spring feeding in Canterbury. Summer-fallowed land is particularly suitable, and larger areas of this valuable crop should be sown. In the north-west shower areas, near the hills, January sowing of Western Wolths is strongly recommended, while February sowings will be more suitable for the plains.

A mixture of Italian rye-grass at 30 lb., with crimson clover at 5 lb., and 3 lb. or 4 lb. cow-grass, per acre will provide useful winter grazing. Where the land is required for spring sowing, Algerian oats or Black Skinless barley also make good winter and early spring fodder.

POTATOES.

Main crops of potatoes should receive attention for weed-control by horse-hoeing and moulding up as growth progresses. Spraying should be done during early growth, and repeat dressings given as required. A suitable spray is Burgundy mixture, which is made as follows: Dissolve 4 lb. sulphate of copper in a 40-gallon barrel; when dissolved, add water to make up to 35 gallons. In another vessel dissolve 5 lb. washing-soda in 5 gallons water. When the soda is completely dissolved, add two parts copper sulphate to one part washing-soda, stirring vigorously all the time. The mixture should be bright blue in colour and be used within ten hours of mixing.

LUCERNE.

Where lucerne stands are becoming infested with weeds or grass advantage should be taken to thoroughly cultivate during hot, dry weather immediately after cutting. Many stands have become badly consolidated this season, and as soon as weather conditions are favourable the soil should be thoroughly stirred with the narrow-pointed cultivator, and every effort made to kill foreign growth which has taken hold as a result of consolidation. Owing to unfavourable weather many areas intended to be sown in lucerne have been held over, and these should be kept stirred with the idea of sowing in February.

BUSH-FELLINGS.

Fallen bush ready for the fire during February should be looked over, and where practicable the axe used to lop branches and compact the fall so as to aid a good burn. This will lessen the amount of logging up in the future. Logging should also be carried out preparatory to firing, and tracks cut for stock. The piling of sticks, &c., on second growth ensures the hot fire necessary to kill the surface roots of troublesome plants such as hard fern and water fern.

On all but the richest bush country, and certainly on all secondary burns, the grasses demanding lower fertility conditions should be sown. Mixtures, however, must be varied to suit the conditions

of the country, its natural fertility, soil-moisture content, rainfall, and aspect. A shady face requires a different mixture from that sown on a sunny face, and the haphazard practice of sowing hill country, with its ever-changing features of faces, knolls, and gullies, with the one mixture is to be deprecated.

MISCELLANEOUS.

The wireworm pest is in evidence in some localities. Good and frequent cultivation, where possible, is one of the best methods of control. On wireworm-infested land it is advisable to grow temporarily such crops as beans, rape, or peas, as these are not to any degree susceptible to attack.

The sowing of Japanese millet under irrigation is advocated for Central Otago. Sown at the rate of 16 lb. per acre, this crop will come in very useful for feeding off during January or February, and in the event of not being required for that purpose will make an excellent hay.

Land which has been ploughed out of old pasture, and which is intended for autumn sowing, should be periodically grubbed, especially where yarrow, brown-top, or other twitches are present.

Thin, old pastures may be allowed to run to seed-head if convenient, and subsequently thoroughly tripod-harrowed. In many instances this method will assist in making a better sole. In the case of young grass it is very necessary not to allow seeding to take place in the first year. If stock cannot be depended upon to check seeding a mower should be used.

—*Fields Division.*

THE ORCHARD.

SPRAYING OPERATIONS.

FROM now onward through the coming month, though spray applications may be made at longer intervals as the possibility of further infection of black-spot becomes less, this disease cannot be overlooked. Everything depends on the weather conditions, and though one might like to discontinue fungicides it is not safe to do so. The strengths of lime-sulphur may be decreased where the foliage is clean, or greater reliance may be placed on the less caustic forms of sulphur sprays during drier weather, with the added degree of safety as to burning. Other factors must also be considered when deciding spraying operations for the rest of the season, chief among which is the prevalence or otherwise of red-mite. If a grower is satisfied that danger from fungous diseases is past, and red-mite is in evidence, he may rely on Black Leaf 40 at 1-800 to keep that pest in check, used in combination with arsenate-of-lead powder, 1½ lb. to 2 lb. to 100 gallons; but where all pests and diseases are to be controlled in the most economical way, the lime-sulphur, sulphur paste, and arsenate-of-lead combination is the most reliable, using ½ gallon lime-sulphur, 6 lb. sulphur paste, and 2 lb. arsenate-of-lead powder to 120 gallons.

Stone-fruits should also still receive attention, using lime-sulphur and a sulphur paste, ½ gallon of the former and 6 lb. of the latter, until the fruit is picked: or ¾ gallon lime-sulphur to 120 gallons may be

used in lieu of the combination with little risk to the trees. The pear crop is usually safe from further black-spot infection from now on, and need only receive arsenate-of-lead sprays, $1\frac{1}{2}$ lb. to 2 lb. to 100 gallons.

At this time cherry-leaf or pear slug will be making its appearance. On cherries it is particularly loathsome, and should be dealt with, prior to picking, with hellebore powder, 1-20. This spray soon dissipates, and does not stain the fruit. On pears the disease will be controlled by the arsenate-of-lead sprays. Plums should also be protected when green with arsenate, and, if ripe, with hellebore.

CULTIVATION.

An endeavour should be made to get all necessary cultivation concluded and cover-crops sown by early January, leaving the land in good condition for the gathering of the fruit crop, which will soon be in full swing.

PREPARATIONS FOR HANDLING THE PIP-FRUIT CROP.

Most growers are hoping to dispose of a greater bulk of the fruit to overseas markets this season, and preparations should be advanced to cope with the increased quantities to be handled. Graders should be overhauled in readiness, cases made up, and packing-supplies ordered in advance, stamps overhauled, and cases labelled. In most orchards and sheds old cases are available which can be used for picking. These should be renailed for the purpose, thus saving the new cases for packing only, so that nothing but clean, presentable packages may be shipped.

While they may concentrate on export, growers must not overlook the fact that the local markets demand every consideration for proper grading and packing, and that lower grades and faulty fruit should not be dumped on to local consumers indiscriminately. Fruit should be packed with all due care, and grades properly defined and stamped on the cases, so that buyers may operate with confidence according to the value of the grades contained therein.

THINNING AND BUDDING.

Other operations to receive attention during the coming month include the continuance of thinning of apples, especially Dougherty, Yates, Scarlet Nonpareil, and other small later kinds which may be still too crowded. Budding of stone-fruits may also be proceeded with, according to the development of the young wood in the several localities. By starting early, observation a little later will disclose whether success has been attained, and, if not, further buds can then be inserted.

—J. H. Thorp, Orchard Instructor, Nelson.

CITRUS-CULTURE.

A prolific flowering of both oranges and lemons indicates an abundant crop, and every effort should be made at this season to keep the young fruit free from pests and diseases, in order to ensure a high proportion of first quality. Owing to the mixed nature of many orchards the citrus section is often rather neglected at this period in favour of the more pressing work, such as the harvesting of stone-fruit, &c. Attention is directed to this because, while it may not be apparent, this is really a most critical time for the citrus crop.

Cultivation of the soil to a fine tilth is necessary to conserve moisture, whereas lack of cultivation results in a severe check to the tree, temporary suspension of fruit-development, and often a heavy fall of leaves.

Spraying should on no account be missed or unduly deferred at this period. Thrips and mites become established on the trees, causing damage to foliage, with partial defoliation; also disfigurement of the rind of oranges in particular. The young of overlapping broods of scale will also be present, and, unless dealt with, these not only inflict damage to the tree but become more difficult to destroy. Suitable insecticides are oil, 1-60, or nicotine, 1-800, plus soap, 3 lb., per 100 gallons. The lengthy period of lemon-flowering results in fruit developing after the main crop has been sprayed, and continuation of bordeaux, 4-4-40, is therefore necessary to ensure all fruit being coated at the fall of bloom.

At this season extended growths are made by lemon-trees (usually about 2 ft. long, but often more) before a natural division takes place. These growths should be dealt with by pinching to cause the division at a more suitable place. An extension of 12 in. to 16 in. is quite suitable. Attention to this work when the shoots are young results in a more sturdy tree, and obviates the necessity for later hard cutting to bring within bounds the heavy straggly growths natural to the lemon.

—W. H. Rice, *Orchard Instructor, Auckland.*

POULTRY-KEEPING.

GUARDING AGAINST VERMIN.

THESE enemies of poultry breed and multiply at an alarming rate during hot weather. It is therefore of importance that every precaution be taken at the present time to guard against vermin getting a foothold. It is a good plan to give the whole of the interior of the house a coating of tar. Tar thoroughly applied not only acts as a good disinfectant, but, in addition, covers up every crack and crevice, the common harbouring-places of vermin, especially of that little night marauder the red-mite.

As to vermin that are found on the body of the fowl at all times, the best way of dealing with these is to provide a good dusting-place. I have lately seen a flock badly infested with vermin, but without a soft piece of ground for them to dust in. It would have taken the owner only half an hour to have spaded up a corner in each of the sun-baked runs and provided the dusting-places the birds were craving for, and, as there were shrubs in every run, conditions were ideal for this purpose. It is not generally known that feather-pulling is frequently caused by birds being badly infested with vermin. As with the majority of troubles affecting poultry, the best of all means of dealing with vermin is by prevention. The great essential is to free the quarters as well as the birds from these pests, and provide ample space for exercise.

It will generally be found that male birds, especially old ones, will not make use of dusting-places. As a result they become infested with parasitic life, and gradually get into a weakened state, making them susceptible to every passing ailment. Therefore:

male birds should be frequently examined, and if found to be infested they should be given a good dusting with a reliable insecticide, care being taken that the powder reaches the skin.

THE QUESTION OF EARLY MATURITY.

While meat in some form is a most valuable item in the dieting of the growing bird, it should be used with the greatest care, for meat may do as much harm when used at the wrong time as it will do good when employed at the right time. The most harmful effect of overfeeding meat is often seen among the young stock, which, instead of growing into good-sized and vigorous birds, have been forced to maturity before they have attained anything like the standard weight requirements of the particular breed they represent. This does not mean that size alone is everything, but, without going to the extreme often aimed at in the fancy show-pen, we should aim at securing birds which, while true to breed-type, possess weight requirements and laying and constitutional points as laid down in the Dominion utility-poultry standards. There is nothing in these standards in a general way which is antagonistic to the best utility type and the possession of the necessary stamina. While the fancier in many cases makes the mistake of breeding for exceptional development of some fancy point, the utility breeder frequently makes an equally fatal error in aiming at early maturity by improperly developed (undersized) stock. In both cases the best interests of the breeds concerned are being injured. To confirm this one has only to observe the large number of undersized and weedy specimens in many of the utility classes at poultry shows.

A happy mean must be the objective. There is nothing to prevent the development of valuable laying strains of all our popular breeds of poultry without destroying their breed character, size, and stamina. It is to be regretted that not only are many strains of White Leghorns becoming weak in breed-type and undersized, but also birds of the heavy breeds, such as Orpingtons, Rocks, and Wyandottes, are commonly seen not much larger than the desired size of White Leghorn. If such breeds are to be refined down to being merely egg-laying machines like the White Leghorn they will no longer hold their valuable general-purpose character. There is at the present time a keen demand for table poultry, and the consuming public are prepared to pay high prices for choice quality, but they are looking for something better than diminutive specimens. So scarce has choice table poultry suitable for the high-class trade been of late that certain poulterers have intimated to me that unless more and better-quality birds come to hand they will be compelled to resort to importation for supplies.

Reverting to the question of early maturity, it is now generally agreed that early maturity is not necessarily an indication of laying-power, nor premature laying a sign of a desirable breeding specimen. Early laying by the well-developed bird is, of course, not a mistake. The foregoing remarks apply in particular to the pullet which commences to lay when little more than half-grown.

BROODER CHICKS WITH CAKED FEET.

A correspondent asks for information regarding the common troubles of balls of earth, &c., forming on the feet of chickens

during the brooder stage. This is mostly found in brooders where the conditions are not ideal, especially in the matter of temperature, and where cleanliness is not strictly observed. If the correct degree of heat is not provided the chicks are induced to huddle, as a result of which the bedding-material, such as chaff, gets away, and, there being nothing absorptive under them, the droppings adhere to their feet and soon become caked. The best remedy is to remove the cause by supplying the desired warmth, and providing ample dry earth or other good absorptive material on the floor, while on no account should the droppings be allowed to accumulate. To remove the balls, it is a good plan to run the chickens for a short time on wet grass, or give them access to a very shallow tray of water. To attempt to remove the caked material with the fingers not only means suffering to the young birds but injury to their tender feet as well.

—F. C. Brown, *Chief Poultry Instructor.*

THE APIARY.

AFTER-SWARMS.

THE beekeeper should give some little attention to the prevention of after-swarms. These swarms are a nuisance, and weaken the parent hive without being of much value in themselves. If the colonies are left undisturbed they will swarm freely, and all chance of a surplus is lost. Among the many plans practised for their control the most successful is that which provides for removing the parent hive. This method is an excellent one, and will usually prevent the issue of the small swarms. As soon as the swarm is hived the parent hive should be removed to a new location in the apiary, and the swarm put on the old stand. The effect of this change is to strengthen the swarm with the field-bees which are absent gathering nectar, and correspondingly to temporarily weaken the old hive, so that it will rarely put out a second swarm. The emerging bees in the parent colony will soon provide sufficient workers to ensure a surplus, and the tendency to swarm will not be so prevalent. In order to make the operation more successful the parent colony should be examined for queen-cells, and they should all be removed save two.

After-swarms should always be returned to the parent colony, unless the beekeeper requires them for increase. In the latter case it is a good plan to dump two or three swarms together, and thus form a strong colony that will gather sufficient stores to carry on through the winter. In dumping, shake the swarms on to an excluder placed between the supers, so as to take out the young queens. Before returning an after-swarm, overhaul the parent hive and cut out all the queen-cells. Place two or three empty combs or frames fitted with sheets of foundation in the brood-chamber, and put the brood over an excluder to hatch out. In case the colony contains a virgin queen, the combs, before being placed over the excluder, should be shaken in front of the hive to make sure that

the virgin queen is not confined above the excluder, or she will not get mated, and a drone-raising colony will be the result. A good plan at all times is to provide an opening for the bees between the super and the brood-chamber, which can be done by inserting a small block of wood immediately under the edge of the super. This will allow the bees to fly freely, and in case the virgin queen is by accident confined to the super an opportunity will be given her to fly and get mated. Likewise the drones can pass out of the super. If on making a later examination the queen is discovered in the super she can be placed in the brood-chamber under the excluder.

FOUL-BROOD.

As advised last month, beekeepers should not fail to treat diseased colonies where found. This work should be carried out in advance of the main flow, so that the beekeeper's undivided attention may be given to securing a crop. Over and over again the treatment of disease is delayed until such time as the season is advanced, and as a result the affected colonies do not count as producers in the main crop; whereas if treatment is carried out as soon as nectar is being freely secreted these colonies will be in good heart to produce a surplus. When the beekeeper is in doubt as to the presence of disease it is advisable to forward a sample of the comb to the Director of the Horticulture Division, Wellington, or to the Apiary Instructor for the district, for examination.

QUEEN-EXCLUDERS.

The season is at hand when it is advantageous to use queen-excluders. During the height of brood-rearing, and in order not to cramp the queen, she should be allowed the full use of the super, so that large numbers of worker bees may be raised to work the main crop. It is not wise to bring the excluders into use too early, and never until such time as the bees are working freely in the super. By cramping the queen fewer bees are produced, and small returns will be netted. Every encouragement must be given to the queen to lay to her utmost, and by so doing populous colonies will be produced.

The best time to put the excluders on the hives is when the main flow sets in and the bees are busy bringing in the nectar. Too many beekeepers make the mistake of putting on the excluders when the supers are first placed on the hives, and it is not an easy matter to get the bees to work in the supers even if combs of honey are raised from the brood-chamber, as excluders tend to make the passage between the lower story and the upper more difficult for the bees. Before placing on the excluders, make a careful examination of the colony to note its condition and to take stock of the number of frames of brood in the hive. If the brood-chamber is full of brood the combs may be manipulated so as to provide the queen with ample room for laying during the period which follows. The best plan is to place the majority of frames of capped brood over the excluder, and to substitute empty combs, taking care to see that the queen is confined below. As the bees hatch out over the excluder they will become accustomed to passing through it, and as fast as the cells become vacant they will be filled with honey. If eggs are

raised with the brood, care must be taken to see that the bees do not raise queen-cells, for in the latter case the hive may swarm out, leaving one or more virgins in the top story, and these queens, being confined to the hive, cannot get out to be mated, and will eventually develop into drone-layers. Within one week after raising the brood, examine the combs in the super to note if any queen-cells have been raised. If any are found they must be destroyed.

The advantage of the use of queen-excluders is in saving labour at the time of extracting, by doing away with the work of picking over the combs. Much time is lost in this operation, and extracting is retarded when everything should be hurried. It is only by the use of excluders that bee-escapes can be employed, and in many seasons, depending largely on the weather, these have to be brought into use.

TREATMENT OF SWARMS : PROVISION OF SUPERS.

There is a little doubt in the minds of many beekeepers who have been accustomed to box hives as to the surplus to be obtained from a swarm. It is not uncommon to find swarms put into frame hives and not provided with room for surplus. Unless supers are given to strong early swarms from ten to fifteen days after they are established these colonies will often swarm again and no surplus will be obtained. It must be understood that the season plays an important part in the returns netted, and large amounts are yearly lost through the beekeeper neglecting to give ample room for the swarm to store honey. When a swarm has been established a few days a hurried examination should be made to note progress, and from this the beekeeper will be able to form some idea as to the time at which the super will be required. Nothing works so well as a swarm under proper treatment, and the attention given in providing supers will amply repay the beekeeper.

QUEEN-REARING.

In last month's notes attention was directed to queen-rearing. Every effort should be made to requeen the apiary during the working season, so that the colonies will go into winter quarters headed by a good queen. It often happens that the beekeeper is dissatisfied with his stock, in which case his best plan is to send direct to some reliable breeder and secure a number of good queens. Whether this suggestion is carried out or not, when raising queens the beekeeper should select the best stocks in his apiary ; in other words, queens should be raised from queens whose bees have a record as honey-producers.

THE HONEY-HOUSE.

Section 18, subsection (5), of the regulations under the Sale of Food and Drugs Act provides that "Every place used for or in connection with the sale, manufacture, preparation, storage, or packing of any food for sale shall be used for that purpose only ; and no place shall be so used which is at any time used as a sleeping-apartment, or in which any animal is allowed to be, or which is or has been used for any purpose which would be likely to contaminate such food or injuriously affect its wholesomeness or cleanliness." It is quite clear from this what is required of the beekeeper in dealing with honey as an article

of food. The producer should remember at all times that, as honey is not subjected to heat to destroy foreign matter before being consumed, too much care cannot be observed in its preparation. The extracting-room should be kept scrupulously clean, and the utensils receive the same care and attention as are necessary in a dairy.

A good extracting-house is an important adjunct to every well-equipped apiary, and unless special attention is paid to the building the tedious work of extracting and bottling the honey will cause the beekeeper a good deal of anxiety during the working season. Perhaps no set plan can be given for the size of a honey-house, and it may be left to the individual beekeeper to erect one to suit his needs. However, it is highly important that ample room should be provided for extracting and bottling the honey, also for storing spare supers during the winter months. Too many beekeepers err in not providing enough space, and extracting operations are consequently hampered and the work of handling the crop is increased.

In addition to plenty of space, good ventilation should be provided. See that the windows and doors are well screened to prevent the entrance of bees, which are liable to become a nuisance during operations. A good plan is to hang the windows on pivots so that they will swing from the centres, thus allowing them to be revolved. Where the windows are fixed it is essential that bee-escapes be used, so that as the bees crawl up the window-frames they will pass through the small holes in the escapes. Suitable escapes can be purchased, or cones may be made of fine gauze and these attached to the screens on the windows.

Where bees are kept in small numbers the question of economy may have to be considered, but it is poor policy to work without a certain amount of convenience. The advantages of working in a roomy, cool, well-ventilated, bee-proof house are many, and the question of expense should not deter the beekeeper from providing the best extracting-house possible.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

THE VEGETABLE-GARDEN.

MANY of the earlier-planted crops will now be coming to maturity, and nothing will be gained by allowing them to remain after that point is reached. There is room for a great deal of good judgment in carrying out harvesting operations satisfactorily. The demand for early potatoes is usually sufficient to account for their prompt removal, but other crops, such as the early onions and others, are allowed to remain after maturity has been attained, and not only is the land idle but the crop actually depreciates. Harvest promptly in fine weather, carefully considering the steps taken. Especially is this necessary where crops have to be stored.

An application of hot limewash, and increased ventilation, would make a valuable increase in the storage returns of some buildings. Each product has its own special requirements in storage conditions, and these must be studied. After thoroughly ripening the crop of onions outside, or in an open shed if wet weather compels, they should

be stored in clean, dry, well-ventilated conditions. To leave them for any length of time in sacks is detrimental. Where potatoes have to be selected for seed, see that they are sound, of true type, and from plants of good habit; such selection will soon obtain a strain of value for both quantity and quality of its produce.

Late crops of potatoes and onions will be just in the middle of their growth, and will require careful attention as regards fungous blights should the weather be close and wet. In the case of such blights, the danger period usually commences early in the New Year, when, if conditions threaten, an application of bordeaux, 4-4-40, should be given, carefully covering the under-side as well as the upper surface of the leaves, and repeating the application after an interval of fourteen to twenty-one days, as necessary. The 4 lb. of rock lime can be replaced in the recipe by 6 lb. of washing-soda if it is more convenient. Such a compound is given the name of "Burgundy mixture." A threatened attack of mildew in the onion crop, which trouble is often prevalent at this season, is best treated in a similar manner, reducing, however, the strength of the bordeaux formula to 2-2-40.

Celery, leeks, brussels sprouts, and broccoli that have been planted out and have become established may be given nitrate of soda, 1 oz. to 2 yards of drill, where necessary, remembering it is inadvisable to force these winter crops hard, owing to the rough weather they usually have to contend with. The planting of these crops, also savoy cabbage, should be completed during the coming month, and in the colder sections as soon as possible. Water the seed-beds well in the evening, pull the plants next morning, and stand them in handy trays for planting out. Plant during the afternoon, discarding all cull plants and rogues—that is, any plants not true to type. If there is any sign of green-fly or other infestation, dip the tops of the plants in a suitable spray wash before planting them. Growers in the warmer localities could very well replace the broccoli with cauliflower, which can be grown in half the time. Varieties for cutting during autumn and winter should be planted now.

Dwarf peas and French beans sown now will produce a useful late supply of these popular vegetables.

THE TOMATO CROPS.

The outdoor tomato crop will commence to ripen now, and arrangements for picking, packing, and marketing will need to be made. While the refinements of packing for the markets of this country can easily be carried too far, the general tendency at present is towards the opposite extreme, and is the cause of much dissatisfaction and loss to the grower. Tomatoes that are mature, coloured, or ripe should be kept in their respective classes, and green, immature, and soft-ripe fruit must be excluded. This demands careful pickers, properly instructed and supervised. Followed up by a reasonably consistent pack, a sound and increasing business will be assured without an unprofitable correspondence regarding complaints and rebates.

The harvesting of tomatoes grown under glass will be more than half completed, and the tendency in the rush of other business is to neglect these plants. This would not be so bad if ample

ventilation were given, which might well be done at this season by leaving the ventilators open night and day. This would be better than leaving the house closed and a prey to mildew, as is sometimes the case.

SMALL-FRUITS.

In order to obtain good results from areas devoted to berry fruits, reasonable attention must continue to be given. Now the raspberry harvest is completed, the old canes and weak misplaced growth should be cut out level with the ground *and carried off and burnt*. Thoroughly spray the remaining canes, as may be necessary, for fungus and insect pests. Strawberry-plots that have run out and completed their career should be ploughed, and the land prepared for other crops. Beds that are to be carried on for another year will need to be cleaned up, and, where necessary, an application of manures made so that the plants may make the most of autumn growth and finish the season in good heart.

Currants, gooseberries, passion-vines, and Cape gooseberries, besides cultivation, require careful inspection at frequent intervals at this season, so that at the first sign of disease suitable remedies may be applied.

TOBACCO.

The work for the month in the tobacco-fields will consist chiefly of topping (the pinching-out of the terminal bud on the main stem as soon as there are indications that the plant has attained its full height) and suckering (the breaking-out or pinching-out of laterals that push out from the axils of the leaves on the main stem), both with a view to throwing the nourishment into the leaves and completing their development. The preparation of curing-sheds should now be completed. It is unfortunate when—as has sometimes happened—good leaf is spoiled by unsatisfactory accommodation for curing.

PREPARATIONS FOR PLANTING.

The autumn season is the most suitable in most districts of this country for the preparation of land and planting of herbaceous plants, to be followed by the planting of evergreen and deciduous trees. Intentions of this kind should now be carefully considered, remembering that the majority of the failures in these crops is due to unsuitable trees being planted in badly prepared ground.

—W. C. Hyde, *Horticulturist*.

Blackberry Investigation.—The investigation into methods of blackberry control or eradication was continued by officers of the Biological Laboratory during the past year. A section of several acres densely covered with blackberry was secured in Wairoa County, where a field experimental area has been established. Researches into the biological, chemical, and ecological methods of control in the field are entailing a large amount of laboratory work, and several thousand tests have been made, mainly of substances for, and methods of, eradication. In addition, experiments with control measures by the use of parasites, both insect and fungous, were initiated, and in this connection mycologists and entomologists have been communicated with in all parts of the world in the hope of securing some useful parasite. Further work is being carried out in several places with top-dressing experiments and the use of goats.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

"PEA" IN THE TEAT.

J. S. WARD, Raetihi :—

I have a heifer that has "peas" in her two front teats. She is worth doing something for, but at present it is a miserable job milking her, as the milk comes in such a small stream. I shall be glad if you can let me know of anything that can be done.

The Live-stock Division :—

"Pea" in the teat is frequently a difficult trouble to deal with. We would advise injecting a little warm water through a teat-siphon and rubbing the teat between the fingers so as to endeavour to break down the pea. The siphon should be thoroughly cleaned and boiled before use. If this method does not prove satisfactory, operation is the only thing, and as this involves a risk of damaging the udder further we would not advise it unless a skilled man is available.

SUBTERRANEAN CLOVER.

"SUE CLOVER," Uruti :—

I would be glad of some information regarding subterranean clover. Is it a good grass to sow on rich, heavy papa river-flats where rushes have been dug; and, if so, would it be advisable to sow it alone or with a mixture? Hard fern is a great pest in this country, and it seems to me that, as its seeding system is somewhat the same as that of subterranean clover, the latter should be most useful in combating a return of the hard fern when it has been burnt. I should like to put in a small patch of subterranean clover with the idea of saving the seed. When and how should the sowing be done?

The Fields Division :—

Subterranean clover is an annual plant with a prostrate habit of growth, the stems spreading over the ground to form a dense mass. The flowers are usually white or a very pale pink, and are carried in clusters of two or three upon short stalks. These stalks increase in length after flowering, and, turning downwards, tend to bury the seed in the ground. The plant is strictly an annual, but owing to its habit of burying its seed it readily reseeds itself, and from a farming point of view behaves more like a permanent plant than an annual. Though it appears to possess a considerable amount of adaptability, subterranean clover prefers a mild climate with a good rainfall, and under such conditions will produce a large amount of late winter and early spring feed. It is quite the earliest of the clovers commonly used, and is relished by all stock. It is, however, not a general favourite in permanent pastures of English grasses, owing to its habit of smothering out the finer grasses in the early part of the season and leaving bare patches after it has flowered and seeded, since it produces very little herbage after midsummer. Hence it is used mainly in conjunction with subtropical grasses, such as *paspalum*, that attain maximum growth in the summer and autumn. Included in the grass mixture, subterranean clover should do well on your river-flats; it will also establish fairly well when included in the mixture for sowing on bush burns in hill country. About the middle of March is the best time to sow. Regarding its use for combating the hard-fern nuisance, experiments with subterranean clover and other plants are being carried out, but these have not been going a sufficient length of time to enable us to give definite advice as to the results. However, owing to its dense habit of growth, subterranean clover should prove to be a useful factor in helping to suppress the hard fern. For the purpose of growing subterranean clover for a seed crop, the best way is to carefully prepare a piece of good, clean, new ground, and sow about the middle of March at the rate of 1 lb. to 1½ lb. of seed to the acre. The seed-bed should be made firm, and care taken not to bury the seed too deeply. When harvesting, it may be necessary to use a rake to drag the seed-pods from the ground.

SILVER-BLIGHT.

A. L. ALLAN, Havelock North :—

Kindly inform me if any method or treatment has been discovered to deal with silver-blight in peach-trees.

The Horticulture Division :—

As far as practical work in the orchard is concerned, it is imperative to carefully sterilize all large wounds, whether made in pruning or by accident, and repeat the dressing annually until they are calloused over. Also all dead branches or trees should not be left lying about, but be burnt before they become a source of infection. A copy of the Department's bulletin on silver-blight has been sent you. In it you will note that the old controversy on this disease is at last settled.

DEFICIENT SHEEP COUNTRY.

“ ROMNEY,” Waipukurau :—

I have a fairly large block of country that sheep never seem to thrive on. It is second-class land—a rather thin soil on a shale subsoil. It has all been in manuka at one time, but is now mostly carrying a thin sole of danthonia. Owing to the deep gullies it is difficult to plough or top-dress. Could you suggest any lick that would help the stock to develop more bone and to thrive better.

The Live-stock Division :—

Any lick containing phosphorus salts would be of benefit to the sheep, and even a few patches of land top-dressed with phosphates would help the sheep considerably. The following forms a good lick: Salt, $62\frac{1}{2}$ per cent.; precipitated phosphate and bone-ash, 35 per cent.; ferrous sulphate, $2\frac{1}{2}$ per cent.

A NORTH AUCKLAND BUSH-BURN GRASS MIXTURE.

D. S. M., Onetea, Dargaville :—

I had bush felled this last winter, and am desirous of getting a good sole of grass through it. I would be pleased if you could give me a good mixture, and the amount to sow per acre. The bush was medium—mostly taraire, with a heavy undergrowth of nikau and fern in places. The ground slopes towards the west, and the formation is clay, hard in places, on sandstone underneath.

The Fields Division :—

The following mixture of seed per acre is advised: Cocksfoot, 8 lb.; crested dogstail, 3 lb.; Italian rye-grass, 2 lb.; perennial rye-grass, 8 lb.; timothy, 2 lb.; red clover, 3 lb.; white clover, 1 lb.; Lotus major, 1 lb.; paspalum, 4 lb.; brown-top, $\frac{1}{2}$ lb.; Danthonia pilosa, 3 lb.: total $35\frac{1}{2}$ lb. Burning would be best done late in February or early in March, sowing as soon after as possible. It must be remembered that careful stocking and spelling of the pasture is quite as important in obtaining a good sole of grass and keeping down secondary growth as is the seed mixture itself.

LICE ON CALVES.

A. M. B., Eketahuna :—

I have some calves troubled with lice. Would you kindly inform me as to the best treatment?

The Live-stock Division :—

We would advise the following preparation to remove the lice: Soft-soap, 1 lb.; kerosene, 1 quart; kerosol, 2 oz.; boiling water, up to 4 gallons. Dissolve thoroughly in the water, then stir in the kerosene. Apply with a spray, or wash well into the hair with a brush. A second application should be made in about ten days.

STRENGTHENING A LUCERNE STAND.

W. E. BRITTON, Tauranga :—

Will you kindly advise me how I may increase a stand of lucerne which was sown in November, 1924, in drills 28 in. apart? Can I sow intermediate rows; and, if so, will the cutting, harrowing, &c., of the established growth interfere with the young plants?

The Fields Division :—

From experiments carried out by the Department, in addition to experience of farmers, the attempts to strengthen lucerne stands by sowing seed have not been successful. We would therefore advise you, if you wish to have a stronger stand, to plough up and resow. The previous crop of lucerne usually helps to secure a better stand after resowing.

RABBIT-POISONING BY STRYCHNINED THISTLES.

WALTER FOX, Christchurch :—

I should be obliged if you would give details as to the preparation of the strychnine paste mentioned in the article "Rabbit-poisoning by Strychnined Thistles," published in the October issue of the *Journal*.

The Live-stock Division :—

The preparation and method of use are as follows: To 1 oz. of powdered strychnine-crystals add 2 oz. of icing-sugar. When this is thoroughly mixed, add sufficient water to make a thin paste. After laying the roots of the thistles bare with a small grubber, scrape the roots clean with a knife and apply the mixture with a brush.

PROTECTING GRAPES AGAINST BIRDS.

W. H. CHETHAM, Whangarei :—

Can you give me any information regarding netting grapes for protection from birds? Last season I had a splendid crop, but lost about 25 per cent. of the best, mostly from pheasants. I made a bird-scarer as described some time ago in the *Journal*, and it was very good for small birds, but the pheasants ignored it. I also covered several rows with scrim, tying some every few feet at the bottom, but they even went inside that.

The Horticulture Division :—

The most effective method of protecting the grapes would be to cover them with netting, such as is generally used for covering cherry-trees. Another method would be to place wire netting unrolled along the sides of the rows, the top edges being drawn together and tied between the second and third wires; the wire netting should also be joined together at the end of the rows.

PRECAUTIONS AGAINST CONTAGIOUS ABORTION.

"CAREFUL," Horopito :—

Would a cow having calved at eight months because affected with contagious abortion be dangerous to take into a clean herd—say, next season—if I leave her to go dry this year and separate her from the others? Would leaving her for twelve months without getting in calf at all be likely to effect a natural and perfect cure?

The Live-stock Division :—

We would not advise bringing the affected cow into a clean herd even after letting her dry off. The germ usually remains in the animal permanently or for some years, and she might infect the bull and thus spread the disease among the rest of the herd. Keeping her empty for a year would not necessarily cure her.

LIVE-STOCK IN NEW ZEALAND, 1925.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1924-25.	Number of Lambs tailed, 1924-25.	Sheep (including Lambs) as at 30th April, 1925.	Higs.		Goats.	
				In Milk.	Drv.				Angora.	Other.		
North Auckland	..	37,997	50	477,143	180,030	24,318	716,040	324,298	774,793	65,354	789	2,168
Auckland	..	46,770	4	681,484	300,149	24,002	606,115	425,596	883,760	107,127	1,320	2,049
Gisborne	..	10,959	53	334,580	20,055	4,737	2,923,007	1,290,651	3,055,726	13,037	257	683
Hawke's Bay..	..	17,421	24	267,154	48,680	7,985	2,739,214	1,208,306	2,950,706	17,785	1,152	480
Taranaki	..	21,599	1	376,843	193,414	10,612	799,467	349,824	786,673	55,513	260	4,386
Wellington	..	43,818	25	701,035	185,597	19,809	5,013,743	2,505,206	5,353,749	70,391	721	493
Nelson	..	7,883	..	65,240	26,205	3,725	366,012	160,262	425,050	14,392	761	529
Marlborough	..	7,252	..	46,247	16,272	2,108	948,459	422,616	1,041,406	7,325	217	2,216
Westland	..	2,525	..	44,881	11,385	2,197	55,799	38,790	63,580	5,030	1	104
Canterbury	..	61,076	12	201,260	82,263	11,177	3,929,398	2,499,973	4,719,959	50,427	204	112
Otago	..	34,471	20	137,389	53,220	8,936	2,567,455	1,285,686	3,021,932	20,643	11	28
Southland	..	26,059	1	170,470	71,379	8,169	1,369,799	850,939	1,470,531	12,101	3	31
Dominion totals	..	326,830	190	3,593,714	1,195,567	127,865	22,335,528	11,407,147	24,547,955	440,115	5,666	13,270
Totals 1924 (or 1923-24)	..	330,430	148	3,563,497	1,184,977	127,612	21,077,684	11,133,336	23,775,776	414,271	5,579	12,617

WEATHER RECORDS : NOVEMBER, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

DURING the month of November, owing to the passage of a number of westerly disturbances with lowest pressure in the South, northerly to westerly winds predominated. The southerly changes on the 6th, 16th, 25th, and 26th, though brief, were very marked, and were accompanied by hail and sleet in several places and followed by frosts.

Between the 12th and 18th a disturbance to the eastward of New Zealand intensified considerably, and the lowest pressure reported from the Chatham Islands was 29.07 in. Another disturbance between the 25th and 29th also exhibited lower barometric pressure than occurred in New Zealand, and caused a southerly gale on the east coast, particularly of the South Island.

The districts of the South Island chiefly affected by these westerlies, and the storms that occurred off the east coast, showed rainfalls above the average; while nearly all other parts of the Dominion apparently experienced less rain than usual.

The Auckland report shows that both rainfall and sunshine were below the November means of former years, and the weather was regarded as unseasonable owing to the prevalence of westerly winds.

On the whole, the weather during the month, though somewhat changeable, was warm, dry, and breezy.

—D. C. Bates, Director.

RAINFALL FOR NOVEMBER, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
<i>North Island.</i>				
	Inches.		Inches.	Inches.
Kaitia	1.94	10	1.08	3.27
Russell	1.90	7	0.80	1.61
Whangarei	1.77	14	0.61	3.41
Auckland	2.44	15	0.60	3.27
Hamilton	3.44	22	1.40	4.05
Kawhia	4.64	20	0.96	4.49
New Plymouth	2.49	21	0.57	4.58
Riversdale, Inglewood	5.12	21	0.84	8.95
Whangamomona	5.20	14	1.11	7.40
Tairua, Thames	1.58	9	0.70	3.55
Tauranga	2.30	11	1.06	3.26
Maraehako Station, Opotiki	1.28	9	0.38	2.78
Gisborne	1.74	8	0.79	3.15
Taupo	2.45	9	0.82	3.41
Napier	0.28	7	0.12	2.08
Maraekakaho Station, Hastings	0.74	7	0.28	2.03
Taihape	2.20	17	0.67	3.67
Masterton	1.42	11	0.38	2.87
Patea	1.93	16	0.34	3.72
Wanganui	0.86	2	0.68	3.31
Foxton	0.72	8	0.20	3.80
Wellington	1.56	15	0.33	3.45
<i>South Island.</i>				
Westport	5.88	23	1.30	7.08
Greymouth	11.28	25	2.37	9.46
Hokitika	14.32	24	3.42	10.73
Ross, Westland	17.54	19	4.04	13.94
Arthur's Pass	17.78	18	3.59	15.00

RAINFALL FOR NOVEMBER, 1925—*continued*.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
<i>South Island—continued.</i>				
Collingwood	Inches. 4·91	18	Inches. 1·09	Inches. 7·68
Nelson	1·25	10	0·59	2·87
Spring Creek, Blenheim ..	0·57	8	0·30	2·41
Tophouse	4·66	14	1·22	7·07
Hanmer Springs	2·24	9	0·62	2·91
Highfield, Waiau	1·16	6	0·47	2·52
Gore Bay	2·12	10	0·70	1·98
Christchurch	2·42	12	0·50	1·84
Timaru	2·26	10	0·70	1·97
Lambrook Station, Fairlie ..	1·70	8	0·84	2·00
Benmore Station, Omarama ..	1·60	9	0·72	2·05
Oamaru	1·98	10	0·62	1·94
Queenstown	2·23	6	1·34	2·77
Clyde	0·86	6	0·36	1·36
Dunedin	4·50	20	0·70	3·30
Wendon	3·36	19	0·38	2·54
Invercargill	4·02	24	0·56	4·60

NEW ZEALAND INSTITUTE SCIENCE CONGRESS, 1926.

THE third Science Congress under the auspices of the New Zealand Institute will be held at Dunedin from 28th to 30th January, 1926.

As previously, the work of the Congress will be divided among a number of sections. Section 1 is that of Agriculture, and will be presided over by Mr. A. H. Cockayne (Department of Agriculture, Wellington), with Dr. F. Hilgendorf (Canterbury Agricultural College) as vice-president. The work of this section will include papers and discussions on modern research methods under both field and laboratory conditions, problems of agricultural teaching in schools and colleges and in extension work, as well as original papers giving the results of research. Full use is to be made of the Agriculture Department's court and plots at the New Zealand and South Seas Exhibition. Section 2 is Biology, with Dr. R. J. Tillyard (Cawthron Institute) as president, and Mr. R. M. Laing (Christchurch) vice-president. The other divisions of the Congress are: Section 3, Geology; Section 4, Chemistry, Physics, and Engineering; Section 5, Anthropology; and Section 6, Social Science and Economics.

In addition to the sectional papers and the discussions arising therefrom, it is hoped that joint meetings will be held for the consideration of subjects of wider interest. Thus it is suggested that a joint discussion be held by the Geology, Agriculture, and Biology Sections on the most useful basis for a soil survey of New Zealand.

During the term of the Congress two public evening lectures will be given—one by Professor C. C. Farr on "The Story of the Universe," the other by Dr. P. H. Buck on "The Coming of the Maori."

The president of the Congress is the president of the New Zealand Institute. The general honorary secretary is Dr. J. E. Holloway, Otago University, Dunedin. The honorary secretary of the Agriculture Section is Mr. E. R. Hudson, Training College, Dunedin; and Mr. W. Martin, District High School, Mosgiel, acts similarly for the Biology Section.

Noxious Weeds Orders.—Gorse has been declared to be a noxious weed within the Te Kuiti Borough.

KILLINGS AT MEAT-WORKS, SEASON 1924-25.

ACCORDING to statistics issued by the Meat Producers Board, the total killings at meat-works in New Zealand for the frozen-meat industry year, 1st November, 1924, to 31st October, 1925, were as follows:—

Class.	North Island.	South Island.	Dominion.	Dominion, Season 1923-24.
Lamb (carcases)	2,044,307	2,705,857	4,750,164	4,769,583
Wether mutton (carcases) ..	1,121,866	149,355	1,271,221	1,019,265
Ewe mutton (carcases)	669,116	283,926	953,042	920,059
Beef (quarters)	445,834	12,715	458,549	322,829
Pork (carcases)	35,286	467	35,753	4,943
Boneless beef (freight carcasses)	204,934	58,804	263,738	266,154
Sundries (freight carcasses) ..	43,889	11,072	54,961	81,994

CROP AREAS AND YIELDS : SEASONS 1923-24 AND 1924-25.

Crop.	1923-24.		1924-25.	
	Area.	Yield per Acre.	Area.	Yield per Acre.
Wheat—	Acres.		Acres.	
Grain	173,864	24·01 bushels	166,964	32·62 bushels.
Chaff, &c... ..	1,629	1·32 tons ..	1,105	1·59 tons.
Oats—				
Grain	63,842	30·77 bushels	147,387	38·72 bushels.
Chaff, &c... ..	326,652	1·12 tons ..	308,527	1·64 tons.
Barley—				
Grain	21,286	28·07 bushels	25,138	31·75 bushels.
Chaff, &c... ..	590	1·61 tons ..	242	1·64 tons.
Maize—				
Grain	8,208	49·40 bushels	8,621	49·47 bushels.
Ensilage	958	6·12 tons ..	600	4·02 tons.
Peas and beans	18,676	19·43 bushels	14,027	29·27 bushels.
Linseed—Seed	12,119	0·22 tons ..	6,679	0·32 tons.
Rye-grass—Seed	43,487	332·58 lb. ..	66,764	452·34 lb.
Cocksfoot—Seed	11,619	122·85 lb. ..	12,258	150·39 lb.
Chewings fescue—Seed	9,279	161·57 lb. ..	4,459	268·69 lb.
Crested dogstail—Seed	4,749	156·53 lb. ..	1,969	198·42 lb.
Red clover and cow-grass—Seed	5,543	143·41 lb. ..	10,400	159·92 lb.
White clover—Seed ..	4,161	132·77 lb. ..	3,196	151·73 lb.
Other grasses and clovers—Seed	2,225	146·84 lb. ..	4,113	272·12 lb.
Grasses and clovers cut for hay	188,979	1·67 tons ..	229,644	1·83 tons.
Potatoes	20,993	5·00 tons ..	23,092	5·27 tons.
Green fodders	239,652	..	240,061	..
Turnips	477,381	..	452,894	..
Mangolds	9,989	..	15,111	..
Onions	374	8·76 tons..	548	9·90 tons.
Hops	701	1,374·34 lb. ..	744	1,542·57 lb.

CERTIFICATES ON SEED-EXPORTS TO CANADA.

THE New Zealand Official Seed-testing Station has been authorized by the Canadian Department of Agriculture to issue certificates to the effect that parcels of seed to be imported into Canada comply with the minimum requirements of the Canadian Seeds Act, 1923.

New Zealand exporters are advised to take full advantage of these new provisions which entirely remove any possibility of the refusal of entry at a Canadian port. Samples should be forwarded direct to the New Zealand station with the specified request that the seed be tested and certified to conform with the Canadian Seeds Act. Representative samples of $1\frac{1}{2}$ oz. to 2 oz. of clovers and 2 oz. to 4 oz. of grass-seeds will be necessary for the analyses. Grading under the Canadian regulations cannot be undertaken here, as this may be done only by a Canadian Seed Inspector. Exporters may receive advice as to the possible grading of their shipments, but no certificate to that effect may be issued.

Check tests of all shipments allowed entry into Canada under a foreign certificate will be made in Canada. If the actual shipment should be inferior to the certificate a sample of the seed will be forwarded to the station issuing the certificate for comparison and check test. Any exporters found to be acting in bad faith would thereafter be denied the privilege of having seeds released from bond without previous examination.

It is hoped that in due course other countries will take similar steps towards facilitating international seed trading.

"LAND LEGISLATION AND SETTLEMENT IN NEW ZEALAND."

A BOOK with this title has recently been issued from the Government Printing Office by the Lands and Survey Department, the author being Mr. W. R. Jourdain, late Chief Clerk of the Department. The main object of the publication—a closely printed royal-octavo cloth-bound volume of some 250 pages—is to afford a summary of the legislation passed dealing with the administration of Crown lands since the foundation of the colony. Laws relating to Native and freehold lands are not included.

The work is divided into the following parts: (1) History of Land-settlement in New Zealand; (2) Legislation of the Imperial Government, Governors' Ordinances, and the General Assembly of New Zealand; (3) Provincial Land Legislation, 1853-76; (4) Legislation by the General Assembly, 1877-1911; (5) Legislation by the Government of Right Hon. W. F. Massey, 1912-24; (6) History of the Lands and Survey Department, 1841-1924. An "Official List" of Ministers of Lands, Under-Secretaries, Surveyors-General, and other higher officers of the Department is appended. A dozen illustrations contained in the book consist of portraits of some members of this personnel.

The publication—into which Mr. Jourdain must have put an immense amount of faithful labour—forms a valuable record and work of reference, which will doubtless ensure for it a wide demand. Nor does the book consist merely of dry summarized enactments, &c.: much of general interest is embodied in connection with the early history of the colony, pioneer surveying and exploration, the various land-tenures, and other phases.

The regular published price of the book is 20s., but it is announced that for the first three months remittances of 15s. 6d. addressed to the Under-Secretary, Lands and Survey Department, Wellington, will be accepted in payment.

RUAKURA FARM TRAINING COLLEGE.

THE first term of 1926 at the Ruakura Farm Training College will commence on 29th January. Students wishing to enrol should make early application to the Director-General, Department of Agriculture, Wellington. An illustrated prospectus giving full particulars of the course may be obtained by applying to the Director-General.

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are complete estimates of the current season's lambing, computed from estimated average percentages furnished by the Inspectors of Stock in the various districts. Corresponding figures for the four previous years, together with the actual numbers of lambs tailed, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
NORTH ISLAND.				
1925 ..	7,463,735	85·64	6,391,812	..
1924 ..	7,148,949	85·00	6,049,654	6,199,881
1923 ..	7,170,154	91·34	6,549,143	6,170,673
1922 ..	6,771,482	90·36	6,118,530	5,955,081
1921 ..	6,312,456	89·65	5,659,355	5,457,643
SOUTH ISLAND.				
1925 ..	6,251,488	78·61	4,914,046	..
1924 ..	5,927,145	87·87	5,208,378	5,267,266
1923 ..	5,892,849	83·99	4,949,313	4,962,663
1922 ..	5,724,572	82·53	4,724,475	4,949,440
1921 ..	5,835,332	83·28	4,895,425	4,810,258
DOMINION.				
1925 ..	13,715,223	82·43	11,305,858	..
1924 ..	13,076,094	86·14	11,258,032	11,467,147
1923 ..	13,063,003	88·02	11,498,456	11,133,336
1922 ..	12,496,054	86·77	10,843,005	10,904,521
1921 ..	12,147,788	86·59	10,518,780	10,267,901

—Live-stock Division.

FORTHCOMING AGRICULTURAL SHOWS.

Waipukurau A. and P. Association : Waipukurau, 22nd January, 1926.
 Horowhenua A. and P. Association : Levin, 26th and 27th January.
 Rodney Agricultural Society : Warkworth, 6th February.
 Te Awamutu A., P., and H. Association : Te Awamutu, 10th February.
 Te Puke A. and P. Association : Te Puke, 10th February.
 Dannevirke A. and P. Association : Dannevirke, 10th and 11th February.
 Pahiatua A. and P. Association : Pahiatua, 13th February.
 Masterton A. and P. Association : Solway, 16th and 17th February.
 Whakatane A. and P. Association : Whakatane, 17th February.
 Taumarunui A. and P. Association : Taumarunui, 17th February.
 King-country Central A. and P. Association : Te Kuiti, 18th February.
 Northern Wairoa A. and P. Association : Mititai, 20th February.
 Tauranga A. and P. Association : Tauranga, 24th February.
 North Kaipara Agricultural Association : Paparoa, 25th February.
 Franklin A. and P. Association : Pukekohe, 26th and 27th February.
 Omaha and Pakiri A. and H. Association : Leigh, 27th February.
 Taranaki Metropolitan Agricultural Society : New Plymouth, 3rd and 4th March.
 Opotiki A. and P. Association : Opotiki, 9th March.
 Morrinsville A. and P. Society : Morrinsville, 10th March.
 Hawke's Bay A. and P. Society : Autumn Show, Tomoana, 16th and 17th March.
 Mayfield A. and P. Association : Mayfield, 20th March.
 Temuka and Geraldine A. and P. Association : Winchester, 25th March.
 Methven A. and P. Association : Methven, 27th March.

Agricultural and Pastoral Association Secretaries are invited to supply dates and location of their shows for publication in the "Journal."